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Contents

	PAGE
The New Deal.—I	317
Contact Work	317
Correspondence	318
District Presidents.—No. 11	318
Industrial Gas and Dust Masks	318
The Position of Designer and Patternmaker in Relation to Foundry Practice	319
Notes From the Branches	321
British Iron and Steel Federation	322
Silicon-Aluminium-Alloy Castings	322
The Testing of Steel Foundry Sands, and the Control of Supplies by Specification	323
International Foundry Congress	326
Iron and Steel Output in October	328
Foundry Training	329
Annealing Malleable Iron	330
Anglo-German Payments Agreements	330
This Week's News in Brief	332
Trade Talk	332
New Companies	332
Contracts Open	332
Company Report	332
Personal	332
Obituary	332
Forthcoming Events	332
Raw Material Markets	334
Applications for Trade Marks	334

The New Deal.—I

The recent elections in the United States have resulted in an enormously increased majority for Mr. Roosevelt, and for some years the Republican party will be in eclipse. The unanimity of the response parallels the return of our own National Government. The New Deal which the President has been engaged in giving has been criticised so much that the result is a little surprising, the bulk of it suggesting that the changes are revolutionary, the rest concerned to make out that the new deal is with an old pack of cards. Our immediate object, however, is to point out the remarkable differences between the election result and the indications of one of those methods of ascertaining public opinion which are so popular in the United States. That country has a passion for data and for questionnaires which is far removed from the distrust with which they are viewed in Great Britain, and generally on a so-called "straw vote" on a public issue their results are surprisingly accurate. In the present case, however, they are the reverse of accurate, as the succeeding points will show. The results, by the way, have been freely published in the technical Press in the States. The National Industrial Conference Board is a well-known national body, and in July it circulated a questionnaire to no less than twelve thousand journals all over the country, inviting the editors thereof to reply to certain queries either in the affirmative or negative. There were 22 questions, asking whether public opinion in the community represented by the journal favoured or opposed certain specific economic and social policies. Personal views were not called for, either editor, paper or readers, neither was any purely political view or party affiliation concerned, and the identity of the contributors was treated as confidential. Over five thousand replies were received from editors representing twenty-five million readers. The replies indicated, for instance, that roughly 58 per cent. were against any compulsory government system of unemployment insurance, and 40 per cent. in favour, while 65 per cent. favoured a compulsory national old age pension scheme, 33 per cent. being against. The total of "yes and no" replies left a residue of doubtful answers, usually about 2 or 3 per cent. We propose to give the remaining figures in a later issue, these being directly concerned with the N.R.A. policies so energetically pursued by the President.

Contact Work

The precise shade of meaning attaching to the word "contact," when applied to the relations between two departments or firms, is of American origin, and the proper method of carrying out this type of work constitutes one of the few things that we can usefully absorb from American practice. As interpreted in this country, contact work between supplier and user is often of a very second-rate character, although conditions are slowly improving. It is often considered sufficient, for example, for a man to pay a perfunctory visit to a user firm about once a month, and, after the fashion of an orderly officer on his rounds, to ask for complaints in a manner which implies that there cannot possibly be anything wrong with the products his firm are supplying, and that, if there is, well, what are one or two blowholes or chilled spots among so many thousand castings, anyway? This type of half-hearted attempt to keep in touch with the user cannot be too roundly condemned in these days of highly-mechanised and high-speed production methods, when a very minor defect may throw a whole factory out of gear.

Contact work, properly carried out, should be of just as much benefit to the foundry as to the engineering concern using the castings. It is not sufficient merely to record and pass back the complaints which inevitably arise from time to time in the machine shop and elsewhere; the good as well as the bad should yield data of value to the supplier. But the wresting of useful information from the complicated systems characteristic of large-scale production demands a more detailed study of the position than is likely to be obtained by a periodic flying visit. This factor has been recognised by a few isolated firms, who have found it definitely worth while to main an intimate contact between themselves and their customers through the medium of technical representatives, who are not concerned with sales matters, but whose duties comprise the careful watching of their firms' products through the fabricating processes of the user, the tendering of advice upon the working of these processes in relation to their products, and the detailed reporting of all relevant matters to their own technical people.

The point we wish to emphasise is that no appreciable good will come from merely listening to complaints and arranging that they shall

(*Concluded on page* 318)

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

A Suggested Method of Establishing Melting Costs in a Grey-Iron Foundry

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The writer was greatly interested in the article under the above heading, most particularly in the cost of metal section, a subject to which he has given considerable attention, and, as the suggested method is open to discussion, he wishes to call attention to points regarding the valuation of own scrap.

The stated aim of the proposals is to obtain a standard method, so that costs may be established on a comparative basis for all foundries, but the suggestion that own scrap be charged at cost would make possible wide variation in metal cost for the same casting in one foundry.

The following will illustrate the point:—

Example 1.—Assuming a mixture is normally made up of 50 per cent. pig at 80s. per ton, 25 per cent. own scrap at cost and 25 per cent. bought scrap at 50s. per ton, the resultant scrap would be charged at (40 + 17½ + 12½) 70s. per ton.

In the event of all own scrap being used in the next mixture, the cost would be (40 + 35) 75s. per ton, but if all bought scrap were used, the cost would be (40 + 25) 65s. per ton. In practice, the costs would fall between the two extremes, but the possible differences are very wide, even when using only one mixture.

If a more expensive mixture was required for a special job, it would have the benefit of using own scrap below its own cost, but would raise the cost of the normal mixture when the special scrap was being used. The following illustrates the point, using the case of a single melt, although the same effect would occur in a lesser degree when dealing with two mixtures in bulk.

Example 2.—Assuming a 15-ton melt of a mixture costing 90s. per ton yielded 5 tons of scrap, this would raise the next 20 tons of the normal mixture 5s. per ton (40 + 22½ + 12½ = 75s., against 40 + 17½ + 12½ = 70s.), or, in other words, the special job would be relieved of 10s. per ton, and £5 extra costs directly due to it would be spread over other work.

It is obvious that the recommended method of charging own scrap at cost will always allow variations in costs, even in standard mixtures, in a single foundry, also costs will depend on the proportion of different mixtures used prior to the work for which the cost is being estimated. Moreover, so long as two components of the same metallurgical value are given two different prices, there is always the opportunity for juggling costs on paper, even if the proportions of own and bought scrap actually used are constant.

If own scrap is valued at bought scrap price, and each mixture is credited with its own scrap at that price, the cost of each standard mixture will then be constant, whatever proportions of own and bought scrap are used, and irrespective of the cost of mixtures previously used; in addition, the castings made from expensive mixtures will bear their own costs.

It is realised that the method suggested would raise the apparent cost of metal, as each mixture would bear the depreciation of the difference between mixture cost and scrap value, but it would relieve the cheaper mixture of an unjust burden and enable prices of standard mixtures to be calculated very closely for estimating purposes over a period, as they would only be subject to market fluctuations, whereas by the recommended method, daily calculations from the scrap inventory would be necessary, apart from the disadvantages mentioned above.

(*Concluded in next column*)

(*Concluded from previous column*)

With regard to the total cost of alloys in a mixture being charged to the casting, this would be fair for such alloys as ferro-silicon, or ferro-manganese, but when nickel is included, such a method would result in a serious overcharge, except when one melt was required, as roughly one-third of the melt would be available for the next melt without the need for nickel additions. In such a case it would be more accurate if the scrap was kept separate and charged at bought scrap price, plus the value of the nickel present.—Yours, etc.,

G. L. HARBACH

(Metallurgist, Worthington-Simpson, Ltd.).

Newark-on-Trent.

District Presidents.—No. 11

Dr. Maurice Cook was born at Hartlepool and educated at the Universities of Manchester and Cambridge. He graduated as B.Sc. with First-Class Honours in Metallurgy in 1919, being the Leblanc Medallist, and received the degree of M.Sc. (Manchester) in 1920. He was assistant lecturer and demonstrator in Metallurgy from 1919 to 1921 at Manchester University, and from 1921 to 1924 he worked at Cambridge in the laboratory of the late C. T. Heycock, F.R.S., on metallurgical research, receiving the degree of Ph.D. (Cambridge) in 1923. Leaving Cambridge he joined the technical staff of Messrs. C. A. Parsons & Company, Limited, Newcastle-upon-Tyne, where he remained until he began his connection with Messrs. Imperial Chemical Industries. He is now assistant research manager of Messrs. I.C.I. Metals, Limited, Witton, Birmingham. In addition, he was visiting lecturer in Metallurgy at the Central Technical College, Birmingham, from 1927 to 1932.

DR. MAURICE COOK.

Dr. Cook is the author of numerous Papers dealing with the constitution and properties of alloys, recrystallisation and grain-growth in metals, the testing of materials, electrodeposition, etc., which are published in the "Journal of the Institute of Metals," "Transactions of the American Institute of Mining and Metallurgical Engineers," "Transactions of the Faraday Society" and the "Journal of the Electrodepositors' Technical Society." He is chairman of the Birmingham Local Section of the Institute of Metals, member of the Council of the Electrodepositors' Technical Society, and chairman of the Midlands Centre of the same society. He was chairman of the North-East Coast Section of the Institute of Metals in 1926.

Industrial Gas and Dust Masks

A comprehensive description of the protective appliances available for dealing with the many gas and dust hazards in industry was given in a Paper read by Mr. J. Davidson Pratt, O.B.E., before the Birmingham Section of the Society of Chemical Industry on November 6.

Dealing with dust masks, the lecturer said the need for a comfortable and efficient dust mask was becoming more and more apparent in order to stamp out the diseases of silicosis produced by the inhalation of silica dust. Wet working and ventilation had done much to reduce the dangers, but there were many cases where such methods would not suffice and where some means to prevent, or at least to reduce the inhalation of dust was necessary. In a few cases a hose mask could be used, but it had obvious limitations, and a dust mask or respirator to protect the nose and mouth was required. There were innumerable designs of dust masks on the market, mostly not very efficient or comfortable. They generally covered the nose and mouth only, and were consequently more difficult to fit comfortably than a complete facepiece. Rubber was generally used for the fitting surfaces, but might be attached to metallic body. The filtering materials generally used were cotton wool or rubber sponge. In some of the designs the wearer had to breathe in and out through the filter. This had often serious objections, and in the better designs an outlet valve for the expired air was fitted. Such masks could not be used where there was any toxic gas present with the dust or where there was a deficiency of oxygen. Work was being conducted by a Government Department to solve the problem of dust masks.

In conclusion, Mr. Davidson Pratt again urged that the safest course was to go with a particular protective problem to a firm which specialised in the design and production of the devices, as that was the only way of ensuring that the protective appliances were in every way satisfactory for the purpose for which they were intended.

Contact Work

(*Concluded from page* 317)

be attended to. A much more active form of co-operation is implied by the American concept of contact work. There are many problems arising in the machining of castings, for example, concerned with both machinability and jigging practice, where the advice of an efficient contact man may materially assist both parties to arrive at a satisfactory solution. The frequent presence in the user's factory of a representative in whom both firms have full confidence also facilitates the carrying out of joint development work on the modification of materials and processes and the investigation of fundamental problems such as cylinder wear.

There are two features which must at all costs be kept out of such relations between supplier and customer. These are the secretiveness which often tends to characterise the outside representative of a manufacturing firm, and that argumentative spirit which assumes that the supplier is always right while the unfortunate machine-shop people are merely making a fuss for the sake of doing so. The position of contact man is thus not an easy one to fill. It is not necessary or desirable that a highly-technical man should spend all his time in visiting customers' plants, but it is most necessary that the man chosen for the job shall have sufficient technical standing to hold the confidence of the technical heads of both his own firm and of those he visits. Otherwise the major qualities called for are tact, helpfulness, and, above all, attention to detail.

The Position of Designer and Patternmaker in Relation to Foundry Practice*

COMPETITIVE METHODS OF PRODUCING CASTINGS

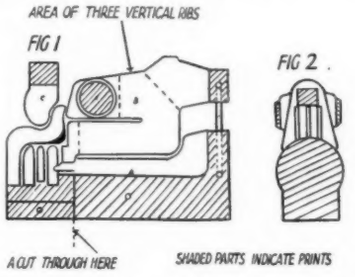
By A. L. Mortimer†

The primary function of the designer is to design a casting for a specific purpose. To achieve that he plans a pattern, endeavouring to make it as simple and often as cheap as possible. In this he has the co-operation of the patternmaker; together they put their best efforts into the work, but when pattern and coreboxes are delivered to the foundry they are sometimes found to be very awkward for practical work, and responsible for costly castings. Obviously this must have been due to a lack of proper understanding of foundry practice, and had the foundryman been consulted the method adopted for moulding might have been materially different. It would, therefore, seem that the planning of foundry work would be somewhat incomplete without some advice from the foundryman. It may be imagined from the foregoing that the foundryman sets himself up on a pedestal and from this lofty position looks down with a certain amount of contempt on the efforts of the designer and patternmaker to produce an article free from foundry faults.

Such is not the case; most foundrymen realise the extremely difficult nature of their job, and only become exasperated when they receive a job in which their part has been planned for them without a proper understanding of their needs, and grumble, not unreasonably, that if they had only been asked the task would have been very much simpler. Designer and patternmaker may retort (and with some truth, although this is gradually being rectified) that many foundrymen cannot visualise a job from drawings. Where this is the case it should not be very difficult to prepare a sketch showing the nature of the job and the proposed method of assembly. The foundryman should then be able to tell with little difficulty whether this is suitable to practical work, and, if not, offer alternative suggestions. The author will endeavour to illustrate his point with some definite examples within his own experience, and, being employed in a modern foundry where machine moulding is general, cores will of necessity loom large in these illustrations. The first concerns a large two-stage pump casing moulded from two half patterns but having a rather complicated coring arrangement, as is shown in Figs. 1 and 2. For clarity, we will refer to the sections as A, B and C. A represents the main core or face of casting and is made from two half boxes. B is the core forming the suction and discharge branches and has three ribs running vertically through it (shown by dotted lines), while another rib cuts horizontally through the centre intersecting vertical ribs. This core was originally made from two half boxes and when pasted is ready for fitting to core A. The gearing part of the casing is represented by C and comprises four half and two complete cores, which when pasted together are also fitted to A, the whole of this section being locked by two end cores crossing the volute. The designed method for closing this job was as shown in Fig. 1. Core A was first fitted with some small bearing cores and the two halves pasted together and bolted. The halves of B are next pasted and the suction end fitted into prints in A, the discharge branch being held in position by a steel bar bolted through the discharge print and again bolted through core A.

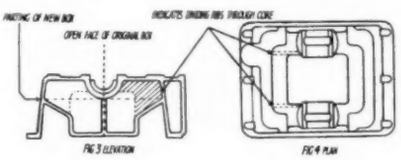
The volute or impeller end of the casing is next fitted on to A, and the assembly is ready for the drying of the pasted parts. When the whole is firmly stuck together, it is ready for closing. Now Fig. 1 shows this assembly as an elevation, but for closing purposes it becomes the plan, which means that the whole must be rolled over on its side, and it is then lifted by hooks screwed into four of the five bolt heads, the centre one of A being missed. It will be obvious that the conception behind this assembly showed great thought and ingenuity, and commands admiration.

At the same time, it will be equally obvious to the practical foundryman that it had some serious disadvantages; firstly, a great deal of



time was spent on the assembling, next there was the roll-over, then the lowering into the mould to be achieved, without damage—no mean feat, considering the nature and area of the prints. Finally, there was the mould thickness-ing. Practically all the mould had to be tested, as, once the cores were in position, the job was practically blind. This necessitated the raising and lowering of the assembled cores several times, which often resulted in damage to the mould, or, worse still, the volute or some other core being caught and broken, and, as the whole assembly was interlocked, it often meant the scrapping of the entire assembly.

It was decided that some simpler means of closing must be devised, and the following method is still in operation. Core A was split at the gearing end, carrying with it the prints for B. The portion C was fitted up as a separate section, exactly as shown in Fig. 1. Core A was fitted with its small bearing cores, but kept in halves. The small connection



through from B to A was cut off, and B kept in halves. Closing now became a very simple matter, in which the moulder could see every part of the job from the bottom up. First of all, the drag half of core A was lowered in, followed by the drag half of B. Next section C was placed in complete, covering the drag print in B. The cope half of A follows, and lastly the cope of B.

Air-Compressor Soleplate

A second case refers to an air-compressor soleplate, shown in Figs. 3 and 4. As the pattern for this job was, more or less, simply a rectangular block of wood, we must again take the cores for our problem. Fig. 3 shows inverse position of cores as closed and cast, the mounting or machined faces of soleplate being cast down. Cores B were formed from one box by a simple alteration, and presented no difficulty. Core A was more of a problem; it consisted of two half-cores made from the same box, the open or plate face of box being shown by the vertical line running through the centre of A. This meant that a half-section of the bearings (which ran right through the core) had to be stamped in from the top, then packed with floor sand before the core was turned over and drawn.

This process was repeated for the other half. It may be asked that, as this appeared satisfactory, what was the matter? Yet in a coreshop dealing with heavily-milled sand there would have been no objections; the job was quite practical, but with oil sand the coremaking medium, the objections were these:—The core stood 15 in. high, was divided into nearly three sections by ribs necessary for casting, was sitting on a base a good deal smaller than its height, supported by floor sand, the packing of which tended to distort the shape of the bearings, while there was always the risk of the floor sand drying and giving way before the core was properly set. Another undesirable feature was the fact that, in closing, the moulder was called upon to fit two half-sets of bearings together whilst unable properly to see them.

It is somewhat puzzling trying to divine the reason for making the box in this manner, the only thing offering a solution being the heavy taper running round the four walls of the core. The core was greatly simplified (and incidentally the closing) by making it in two half-boxes, with the parting as shown by horizontal line running through Fig. 3, the taper being obtained by ends and sides of the box left loose to draw with the core. The patternmaker is very often circumscribed by the class of pattern he is permitted to make. Sometimes the pattern may be for a special design, and the likelihood of repeat orders very remote, but, whenever possible, he should endeavour to give the foundryman as good a finish as possible.

A coat of paint, varnish, or enamel prolongs the life of a pattern naturally, ensures that it strips properly, and gives to the machine shop castings truer to size. Even if a pattern be cheaply constructed or made of poor wood, that coating of paint is worth applying; it often saves its cost many times over in the foundry. It sometimes happens that some pattern is wanted for one or two off; it is never likely to be wanted again, so the merest skeleton of a pattern is rigged up, and the coring left to sweeps and boards. It is with one or two of these latter that it is proposed to deal.

Domed Cover

In foundries adapted to modern methods, sweeps are not too welcome, and in these days many jobbing shops have embraced oil-sand cores whenever possible. Now the patternmaker is rather prone when constructing patterns of a jobbing nature, to think of the old days. For instance, a simple dome-shaped cover with flange, as shown in Fig. 5. He provides a skeleton pattern and a sweep and board for the core—a flat board with sweep to the necessary shape, dowelled in the centre. This predetermines that the core must be made in a heavily-milled sand, with probably a cast grid for lifting off the board. All coreshops using oil sand need plates, and one of these plates can have a hole the size of a dowel pin in the centre, which will permit the use of oil sand. If the patternmaker knows that oil sand is used, he can help by providing in place of the board a ring of wood to form the bottom part of the core, cutting his sweep to rest on or round this, as is shown in Fig. 6.

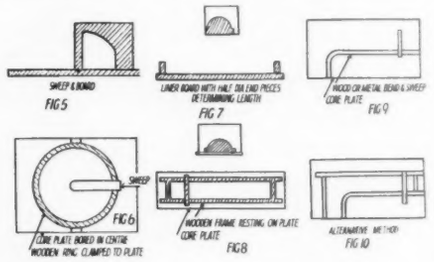
Liner and Barrel Cores

The same principle can be applied to swept liner or barrel cores, and even pipe bends. In the first case, the board is usually provided with two end-pieces cut to the diameter, and determining the length of core desired. If the

* A Paper read before the Scottish Branch of the Institute of British Foundrymen.
† The author was awarded the Surtees Gold Medal for this Paper.

XUM

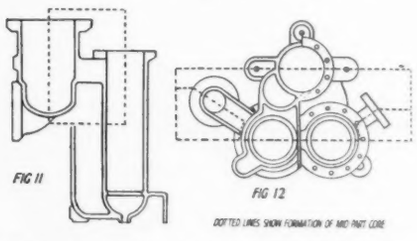
bottom board is removed and the end-pieces are retained and joined together with two strips of wood, one on either side of the diameter, it again becomes possible to lay it on a plate, dispense with grids and use oil sand, as shown in Figs. 7 and 8. For a pipe bend, all that the patternmaker needs to provide is a strip of wood, taking the inner bend of the pipe and lengthened to allow it to be clamped to a plate, the sweep being cut to suit this. An alternative is to make the bend as for a liner, using the inner bend for one of the strips and simply making the outer bend as in a liner, leaving the coremaker to shape it (*vide* Figs. 9 and 10).


SWEEP & BOARD
FIG 5
LINER BOARD WITH HALF DIA END PIECES DETERMINING LENGTH
FIG 7
WOOD OR METAL BEAD & SWEEP CORE PLATE
FIG 9
SWEEP
FIG 6
CORE PLATE BORED IN CENTRE WOODEN RING CLAMPED TO PLATE
WOODEN FRAME RESTING ON PLATE CORE PLATE
FIG 8
ALTERNATIVE METHOD
FIG 10

In the examples quoted, workmanship was of the highest order, and the troubles in the foundry sprang purely from a lack of understanding of the foundryman's real needs. When brought to the notice of the management, these misconceptions were immediately rectified, the designer or patternmaker invariably expressing his appreciation at having the foundryman's point of view.

Vertical Pump Body

The object of what follows is to show planned and designed alternatives to the orthodox methods of moulding, and to demonstrate how the foundryman, by using his own working materials, can sometimes supplement or simplify a pattern of an awkward nature in such a manner as to be able to produce the casting more economically. The first example is a vertical pump body, shown in Figs. 11 and 12. This casting is made in sizes ranging from $2\frac{1}{2}$ in. to 10 in. bore, and the procedure described is common throughout the range. Normally a casting of this nature would be moulded in a three-part box, usually by hand ramming, jolting, plate, or occasionally by the sandslinger. The mould would then be stripped, finished and dried. The mid-part box would call for much gaggering, with the exercise of extreme care in finishing and handling before drying to maintain its correct shape. Another glance at Fig. 11 will show that the need for a three-part box is due to the formation between barrel and valve box, but apart from that the casting could be made in a straightforward two-part box.



The simple solution, therefore, is a midpart core extending only far enough to take in the section necessary, that is, taking a line through the centre of the valve box to the centre of the barrel and stopping as soon as it passed the valve box. It will be noted that the discharge branch and also by-pass connections are set at an angle in what is now the mid core, and it may be wondered how it is made. The half section of valve box becomes the bottom of corebox while the barrel and port with half columns attached (termed the saddle for short) is affixed to a bar of wood dowelled into the top of box. The mid core carries only a half-section of discharge branch and by-pass connections set on block prints, the opposite halves being formed by two separate cores fitting into these prints. Thus there is a straightforward mid core made as follows:—The saddle is left out until the box is rammed well over the valve-box portion, then it is inserted in dowells which still leaves the box fairly open, allowing the coremaker to get all round it without difficulty. When the box is rammed up and scraped off, the saddle is rapped and lifted out. The cavity is then lined with thin paper and packed with ordinary coresand, wires and two lifting hooks being inserted in this portion. The coreplate is laid on the whole, rolled by the machine and drawn. When the mid part is baked, the portion filling the saddle cavity is lifted out, clearances filed at certain points, and it is used in place of packing in other mid-part cores. These sand formers last for quite a long period, and give a much truer shape and better baked core than can be obtained by packing with floor sand. The cost of mid-part cores varies according to size, but in all cases it is a good deal cheaper than a mid-part mould, while the pattern has become a plain two-part machine job made and cast in green sand. The saving in firing, handling and the increase in production will be realised.

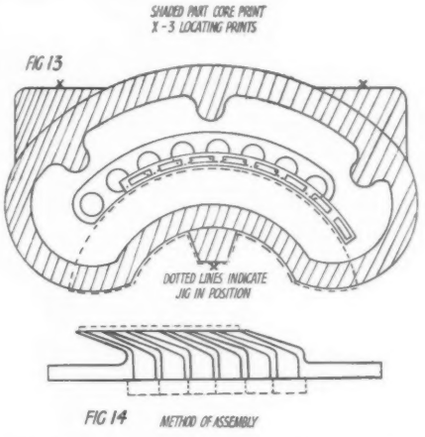
Turbine Nozzle

Another example concerns a turbine-nozzle segment, a fairly small but very important casting. These castings may be required with five, eight or eleven nozzles per segment, and extreme accuracy in casting is essential. The usual method is to mould them with the throat of the nozzle downward, placing each core in position singly, the cores being held by a print in drag and cope, the cope print having to close over the eight nozzles assembled in the drag. An alternative method, or rather the same method differently applied, consists of inserting the cope print in a corebox and deepening the drag accordingly. This allows the nozzle cores to be mounted on the print core in the upward position, exact alignment being obtained by the use of a jig which fits as in mould-locating prints, as is shown in Figs. 13 and 14. This permits the whole segment to be securely pasted together and lowered into the mould as one unit. Whilst the moulder is unable to see what he is doing when closing this job, he has only to watch the locating prints in the core holding the nozzles to be quite safe as the upper and lower prints make contact with the sand at the same time, and if nozzles are accurately jigged the whole fits snugly together. A plain cope is used for holding the core down. It may be thought that this method does not show much saving, and although these cores can be jigged very quickly, the real advantage lies in the elimination of wasters and the extreme accuracy of the casting.

Gear Panel Case

An example of a somewhat different nature is furnished by an electric gear panel case $14\frac{1}{2}$ in. long, $5\frac{3}{4}$ in. high and 11 in. wide. The pattern for this was simply a casting, shown in Figs. 15 and 16, made in brass with one coreprint forming a window on one side of the casting. This was obviously meant to be a loose-pattern job, and as the order was for 25 off, the question presented itself, was there a speedier and more economical method of producing it? To this end the window coreprint was lengthened to stretch from top to bottom of casting. It was then decided that the interior of the pattern would do for a corebox. Two small holes were drilled through the horizontal sections on each side of the window and blocks of wood screwed in. This allowed the pattern to be turned over, the narrow part placed on a plate and the whole clamped to the core machine. The small rectangular portion was rammed up to the shoulder and flushed off. A print fixed to a bar of wood which rested across shoulders, as shown in Fig. 15, was impressed into the sand slightly off centre, and two bent sprigs to act as lifters inserted. This was covered with a piece of thin paper, the print impression being left clear and dusted with parting sand.

The remainder of the core was then rammed up, two sprigs again being inserted for lifting purposes. When the cores were dried the top and bottom portions were numbered before being parted, thus ensuring that each half-core would be used to fit its own print impression. When

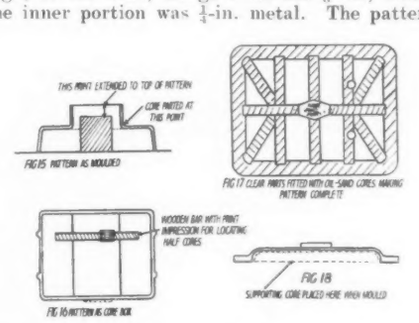


cores were completed the wood was removed from outside of pattern and two rectangular pieces, cut to fit the top and bottom, inserted and stayed flush, thus blocking up the interior of pattern. We are now left with a pattern which can be jolted and turned over on the machine and, being complete, requires no dowelling or very accurate positioning. For closing, the window core is first inserted, followed by the small portion of main core, correct thickness being obtained by trying a flat piece of wood $\frac{1}{4}$ in. thick round the four walls.

The larger portion of core is then lowered in, the print on this half fitting into the impression in lower half. This served a double purpose; it locked the two half-cores together and as the one half bore the exact impression of the other, it showed that, if the metal thickness in the top half was correct, the lower half (now blind) must have maintained its position. A plain cope completed the moulding of this job, which was finished in a very much shorter time than was originally anticipated.

Door Casting

The next example concerns a door casting, probably for a crankcase. The door was $21\frac{1}{2}$ in. high, 17 in. wide, flange thickness $\frac{5}{8}$ in., whilst the inner portion was $\frac{1}{4}$-in. metal. The pattern


THIS PART EXTENDED TO TOP OF PATTERN
CORE PASTED AT THIS POINT
FIG 15 PATTERN AS MOULDED
FIG 17 CLEAR RIBS FITTED WITH OIL-SAND CORES MAKING PATTERN COMPLETE
WOODEN BAR WITH PRINT IMPRESSION FOR LOCATING HALF CORES
FIG 16 PATTERN AS CORE BOX
FIG 18
SUPPORTING CORE PLACED HERE WHEN MOULD

was skeleton built, having $\frac{1}{4}$-in. strips of wood fixed across from one side of the flange to the other, with a name-panel print fixed in the centre, as shown in Figs. 17 and 18. As will be seen, apart from the flange, this pattern had more space than wood about it, and was inclined to be somewhat fragile even for hand moulding. As the order was for 18 off, the question of method again cropped up, and once again a departure from the obvious was made. Now oil sand in the foundry has uses other than its primary one of making cores.

By carefully increasing the quantity of oil binder, it can be made to yield a sandstone of an endurable nature, taking almost any shape desired. In dealing with this door, the foundryman became his own patternmaker in the finishing of the pattern by adopting the following procedure. The hollow face was turned up, lined carefully with thin paper, and the hollow part filled with ordinary oil sand to the face of the flange. A plate was then laid on this face and the whole turned over, which left the rounded shape uppermost. The next move was to take some of the oil sand with additional binder and pack in the spaces between the wood in the pattern. It was then smoothed down to the contour of the pattern, four pieces of wood being nailed together to form a frame round the edge of the flange. This frame was then filled with floor sand, a plate laid on top and the whole turned over. The pattern was then lifted off, leaving the core-sand section between the wood on the sand bed, whilst the sand used for filling the hollow part was returned to use.

The sections in the bed were fired to the hardness of stone and then glued into the pattern, making it a complete entity. The oil-sand core, however, is rough and porous, and not likely to give a very good draw. This is overcome by rubbing a piece of fairly dry putty over the core surface until it has clogged all the pores. A stout piece of cloth or a piece of old fine sandpaper rubbed over this again will be found to leave a surprisingly good surface, which can be varnished to a glass-like finish. After the pattern has become properly dry, the hollow portion is again filled with core sand, but this time having the additional binder, the core being strengthened with rods and two lifters inserted at the joint face, while a sprig is laid on the surface at one corner and a corresponding mark made adjacent on the wooden flange of the pattern. When this core is withdrawn and fired, the pattern is ready for moulding.

The pattern is laid on the machine plate with the name panel upwards, the flange and supporting core being on the plate. The cope box is laid on, sand tucked round the pattern, and the box jolted in the ordinary way. The box is then turned over and the core lifted out. The drag box is next laid on cope and the two bolted together and placed on machine again; sand is now tucked into the upper box and the double box jolted. When finished they are lifted off, parted, and the pattern withdrawn, leaving only name core to be inserted to complete the mould.

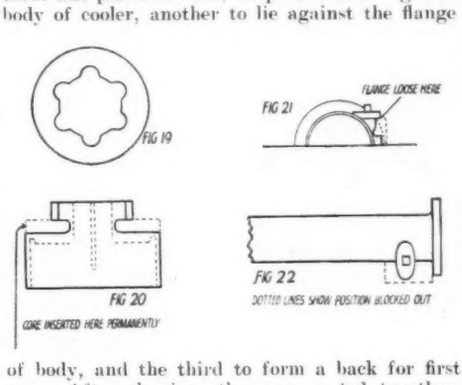
Circular Covers

Two further examples of the principle shown in the above will help to prove that it is not so limited in its scope as might be imagined. Figs. 19 and 20 show a circular cover made in gunmetal, having an embossed flange separated from the main body by a space of $\frac{3}{4}$ in. This flange was loose, being fixed to the branch on main body by two dowel pins. Generally, for dealing with this pattern, the moulder would ram up, tuck the sand underneath the flange and then flush with the top. He would obtain a cake-core larger than the flange diameter, lay it on top, ram around it, lift it out, then withdraw the flange, and after replacing the core, finish off the box. Now the moulder must be provided with a core in any case, so it is wise to return to the pattern and see if there be a simpler one. By removing the loose flange one is left with pattern having only branch connecting to the main body, or the distance between the body and flange. The pattern is laid on a core plate with the branch *down*, core sand is tucked in round the branch until it reaches the full diameter of the body; it is then smoothed round and the pattern withdrawn, leaving a core the diameter of the body and depth between the body and flange.

This core is dried and a fillet made round the branch in the centre. One-sixteenth of an inch is then carefully filed off the outside diameter and the core placed in any corebox or frame lying, having a larger diameter and greater depth. It is filled with strongly-bonded core sand, turned out on a plate, and a core is made from the pattern withdrawn. This core has a strip of cardboard $\frac{1}{16}$ in. thick glued round the outside diameter, restoring it to its former size, the diameter of the pattern, to which it is returned, the flange being replaced and screwed permanently into position, making a straightforward machine-draw pattern. The core made from this print is treated with putty and varnish, and becomes the corebox, the $\frac{1}{16}$-in. smaller diameter allowing clearance for fitting.

A Cooler-Body

As a final example a cooler-body having a pipe connection with oval flange situated near the body flange is presented. The core-print for pipe is fixed on top of the flange, which is loose, involving again the placing of a cake core on top of flange, making the impression, taking it out, withdrawing the flange, and then replacing the core! A better method is to take three flat pieces of core, shape one to lie against body of cooler, another to lie against the flange



of body, and the third to form a back for first two. After shaping, they are pasted together, and when placed against pattern leave a space, which when filled with strong core sand forms a block print from the cooler-flange to body of the pattern, taking in the pipe section and reaching from the plate face of the half-pattern to the underside of the pipe flange. This then becomes the pattern print. When dried, an impression is taken from the metal face of this print and dried.

The two are then fitted together, the outside walls tapered if necessary and a wooden frame nailed closely round them. The original is then withdrawn and $\frac{1}{16}$-in. cardboard glued round it and varnished, after which it is screwed to the pattern ready for use. The print remaining in the frame is touched up and varnished and becomes the corebox. It will be seen that this makes the pattern straightforwardly, the portion beneath the pipe flange being blocked out. The flange and print can be left permanently on the pattern, whilst the counterpart impression provides a core the exact shape of that part blocked out.

(*Concluded from next column*)

Don't forget that a life may depend on that casting.

Don't forget that you are a member of a highly-skilled trade; your castings denote how high your craftsmanship may be placed.

Don't forget that these Don'ts are but a few; there are many others, and we will add one more:

Don't forget that it is up to you to place the moulders on a higher level.

Mr. Norman Cook, President of the Lancashire Branch, concluded by wishing the Section a very prosperous session and urged every one present to play his part in making it so.

Notes From the Branches

Lancashire Branch, Junior Section.—The Chairman (Mr. A. L. Key), in his opening address at a meeting of the Junior Section of the Lancashire Branch held recently, gave a survey of the improvement in the foundry trade and expressed his views in regard to the future. There was a shortage of good foundrymen available at present and he (Mr. Key) explained the advantage and opportunities which were offered to young foundry workers by becoming members of the Junior Section, whereby they could improve their knowledge by coming in contact with members of the Senior Section, the majority of whom were men of broad experience, both practical and technical, and who could enlighten them on question which were outside the ordinary teaching of foundry classes. It was a unique opportunity to acquire valuable knowledge so as to prepare them, when the opportunity came, to take their place among the leaders of the foundry trade.

The following awards were made:—Mr. O. Batison, John Wilkinson Medal examination winner; Mr. A. G. Adams, book prize for second place (this medal is presented annually by Mr. J. Thewlis Johnson, of Bradford Iron Works, Manchester); Mr. A. E. Boyes, book prize for winning the Short Paper competition.

Some fifty-five interested youths took part in a heated discussion on foundry problems, after Mr. A. Phillips, a well-known member of the senior branch, opened the actual business of the meeting with a few explanatory notes on bronzes and what was meant by the "break" on a metal, most useful in the production of non-ferrous castings. He showed several samples, parts of defective castings, and runners and gates.

Mr. W. Dudley sent his best wishes to those present and also this list:—

Don't forget that a clean mould is half the battle.

Don't forget that your eyes and head work before your hands, that is, if you are a good workman.

Don't use sand too strong, nor ram too near the face of flat surfaces; they will surely scab.

Don't forget that the rammer is a delicate tool and must be used with care.

Don't forget that the coremaker went to a lot of trouble to make that vent; it concerns you.

Don't forget, a "fin" before a "crush."

Don't blame the metal.

Don't say the mould was all right until you put the metal in.

Don't have dirty bushes.

Don't forget to try your thickness, for studs, chaplets, nails (not rusty ones) with loam.

Don't forget to remove the loam.

Don't stop pouring to have a word with your mate; a full bush all the time keeps up the pieceworker's earnings.

Don't tighten one side of the bar that holds down the core; tighten little by little at both sides.

Don't stop pouring, even if the metal runs out slightly. Keep the bush full; it may freeze (even in summer).

Don't forget your weight; a ton over is better than an ounce under weight.

Don't be afraid to ask for information.

Don't knock the pattern about; it may be wanted another day.

Don't forget that if a pattern could speak, it would often cry out for mercy.

Don't feel you know everything; a lifetime is but a short spell to learn all.

(*Concluded in previous column*)

British Iron and Steel Federation

APPOINTMENT OF INDEPENDENT CHAIRMAN

The Executive Committee of the British Iron and Steel Federation, at their meeting held in London last Thursday, decided to appoint Sir Andrew Duncan as their independent chairman. Provision for this appointment was made in the Constitution, which was adopted at the general meeting of the Federation held in April last.

The independent chairman will perform entirely new functions, particularly in relation to the co-ordination of the diverse interests of the many different industries comprised within the membership of the Federation; this will involve commercial and economic problems, the organisation of associations representative of individual industries and products and the affiliation of such associations to the Federation, which thus becomes in the fullest sense the national organisation of the iron and steel industries. Sir William Larke will retain the position of director, which he has filled since 1922 with great distinction, but, owing to the change in the Constitution, with enlarged functions and responsibilities.

The appointment of an independent chairman marks an important step forward on the part of the Federation towards carrying out its pledges to the Government, and should expedite the consideration now being given to the recent application for an increase in duties on imported steel, and lead to a favourable decision within the near future.

The functions of a chairman are outlined in the Constitution of the Federation. It is pointed out with regard to the chairman's casting vote that—

> "In case of equality of votes on a matter raised at any meeting, whether upon a show of hands or on a poll, the chairman of the meeting in question shall be entitled to a second or casting vote unless the contrary is expressly provided. When the independent chairman presides at any meeting of the Executive Committee or other Committee, he shall only vote when otherwise there would be equality of votes."

In view of the interest which the appointment of an independent chairman naturally arouses, it may be of interest to review briefly the objects of the Federation as given in the Constitution.

It will be recalled that the Federation was formed to promote and foster the formation of associations in the industry with a view to their affiliation to the central body. It will exercise such measure of co-ordination in matters of general policy as is necessary or desirable to secure the orderly progress of working of the industry; and assist any affiliated association to promote the efficient organisation of the section of the industry with which it is concerned. The Federation will also organise and regulate, in consultation with the affiliated associations concerned, the control and disposal of imports of iron and steel products, and co-operate with affiliated associations in promoting or regulating the export trade. The complete autonomy of each affiliated association within its own branch of the industry is the governing principle of the Federation in carrying out these objects.

The Council of the Federation comprises 29 persons engaged in the industry to be elected annually by the members of the Federation in the various districts in Great Britain: Derbyshire, Leicestershire, Nottinghamshire and Northamptonshire will have two representatives; Lancashire, Denbighshire, Flintshire and Cheshire two, in addition to two representing the North-West Coast; Yorkshire two, in addition to three for Sheffield and four representing the North-East Coast; Lincolnshire, two; Scotland, four; Staffordshire, Shropshire, Worcestershire and Warwickshire three, and South Wales and Monmouthshire five. There will be in addition not more than 41 persons engaged in the industry appointed by and representing affiliated associations in such proportion as the Council may from time to time determine. Whenever election by districts does not secure adequate representation of any section of the industry on the Council, the Council may co-opt additional persons for the purpose, not exceeding a total of 10 per cent. of the number of the members of the Council (other than co-opted members) at the time.

The Executive Committee consists of 20 ordinary members of the Council elected by the Council, together with the following members *ex-officio*:—(*a*) The President; (*b*) the respective chairmen of the Parliamentary Committee, Transport Committee, Tariff Committee, Research Committee and Central Council of Wages Associations, and also if and when the Council think fit of any Export Committee or Company; (*c*) an independent chairman to be appointed by an extraordinary resolution of the Executive Committee. It will thus be seen that whereas the Federation, under its original constitution was concerned purely with the production side, its functions now cover the commercial side also.

Any association concerned with one or more products of the industry will be entitled to apply for affiliation, which will be for a period of not less than five years. Thereafter withdrawal may be effected by giving twelve months' notice to expire at the end of any financial year. The Executive Committee will have power to admit Empire members. Each affiliated association will pay to the Federation annually a subscription of £100, or such lesser sum as may be from time to time arranged between the Executive Committee and the affiliated association concerned. Each Empire member will pay an annual subscription not exceeding £250, the amount of such subscription so payable in each financial year to be fixed by the Executive Committee.

In order to raise sufficient funds to carry on the work of the Federation, levies will annually, or more frequently if necessary, be made by the Executive Committee upon all members (other than Empire members) *pro rata* according to the amount of wages paid during the last preceding financial year. For this purpose wages include those paid to all persons engaged in the industry either directly or indirectly in the manufacture of iron and steel products and in any finishing processes from the receipt of materials at the boundary of the works up to and including the despatch of the finished product, also persons engaged in the operation of any services, and in maintenance and repair work and supervisory labour.

SIR ANDREW RAE DUNCAN, M.A., LL.D.

(Independent Chairman of the Executive Committee of the British Iron and Steel Federation.)

SIR ANDREW RAE DUNCAN, M.A., LL.D., was born in 1884; he was Coal Controller from 1919 to 1920, and chairman of the Advisory Committee of the Coal Mines Department from 1920 to 1929; he was also chairman of the Royal Commission to inquire into the Coal Industry in Nova Scotia in 1925; he is chairman of the Central Electricity Board, a director of the Bank of England, and a member of the Economic Advisory Council.

Provision is made for arbitration if any dispute arises out of or in connection with the provisions of the Constitution, if all parties thereto so agree. For this purpose the Council may either appoint a committee of their body or else appoint a member of the Council as a single arbitrator, provided that the persons so appointed either to serve on such committee or as such single arbitrator shall not have any interest in the product which is the subject matter of the dispute or be connected with any branch of the industry involved therein. Alternatively, if any party desires it, they may resort to outside arbitration.

Silicon-Aluminium-Alloy Castings

NEW D.T.D. SPECIFICATION

The Air Ministry has issued material specification D.T.D. 240 for heat-treated silicon-aluminium-alloy castings, and covers the alloy generally known as "Alpax Beta."

Chemical Composition.—(*a*) The chemical composition of the castings shall be (per cent.):—Silicon, not less than 10.0 nor more than 13.0; iron, 0.60 max.; manganese, 0.60 max.; magnesium, 0.60 max.; total other metallic impurities, 0.20 max.; aluminium, the remainder.

Heat-Treatment.—(*a*) The castings shall be delivered in the heat-treated condition. (*b*) The castings and test samples shall be heated to a temperature of 150 to 170 deg. C., for not less than 16 hrs. and cooled in air or quenched in oil or water.

Provision and Preparation of Test Samples.—(*a*) At least one test sample shall be cast to represent each large casting. When castings are made from more than one charge and the charges are not mixed prior to casting, a test sample shall be cast from each charge. When small castings are made by taking metal from a larger charge, one test sample shall be cast for every 100 lbs. of metal poured. (*b*) The metal for the test samples shall be taken directly from the same crucible or ladle of metal from which the casting or castings will be poured. The metal so taken shall not be subjected to any treatment other than cooling down to the appropriate pouring temperature. (*c*) The test samples shall be cast in dry sand moulds of the dimensions laid down in the specification. The mould shall be rammed in one piece; it shall be inclined at an angle of 30 deg. from the vertical during pouring and shall be poured from the top.

Tensile Test.—(*a*) The test-pieces must comply with the following tests, which shall be carried out to the satisfaction of the inspector. The testing appliances shall be such that the load when applied is axial. Should a tensile-test-piece break outside the middle half of its gauge length, the test may be discarded and another test made. (*b*) When tested they must give the following results:—Max. stress not less than 11.0 tons per sq. in.; elong. not less than 1.5 per cent.

NOTE.—This specification is one of a series issued by the Air Ministry either to meet a limited requirement not covered by any existing British Standard Specification, or to serve as a basis for inspection of materials, the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardisation.

New Nitriding Cast Iron

A new nitriding cast-iron composition, containing no aluminium, has recently been patented in the United States. Under U.S. Patent 1,972,082 a French metallurgist has assigned to the Nitra Cast Iron Corporation of Delaware a composition of the following approximate range; Carbon (total), 2 to 4 per cent.; manganese, up to 1 per cent.; silicon, 1 to 4 per cent.; chromium, 1.5 to 3.5 per cent. If other elements are included, the tungsten content is not to exceed 2 per cent., and the titanium, vanadium and molybdenum not over 1 per cent. After nitriding cast iron of the above general composition, the Vickers-Brinell hardness has been raised in one case from 490 before nitriding to 710 after, and in another from 424 before to 780 after.

The Testing of Steel Foundry Sands, and the Control of Supplies by Specification

By T. R. Walker, B.A.

(*Concluded from page* 307.)

Sieving Tests

The division of the sand mechanically into particles of different sizes may be carried out completely by sieving. It is far better, however, to remove the fine particles which comprise the clay and the silt by means of elutriators, in which the sand is placed in a glass cylinder, through which an ascending stream of water is flowing sufficiently rapidly to carry away the small particles, while leaving the large particles behind. The mesh sizes of the sieves used have not been standardised, but the division of particle size frequently adopted in this country results obtained by different workers. A comparison of different systems is shown in Fig. 4. The horizontal scale is a logarithmic millimetre scale, and the sieve numbers or designations are located according to the width of aperture. It will be noticed that in some cases there is a considerable difference in the positions occupied by corresponding sieve numbers. The laboratory sieves referred to are sieves purchased in the ordinary way, and may vary considerably in size of opening, since the number of the sieve refers only to the number of holes, without the diameter of the wire forming the sieve being

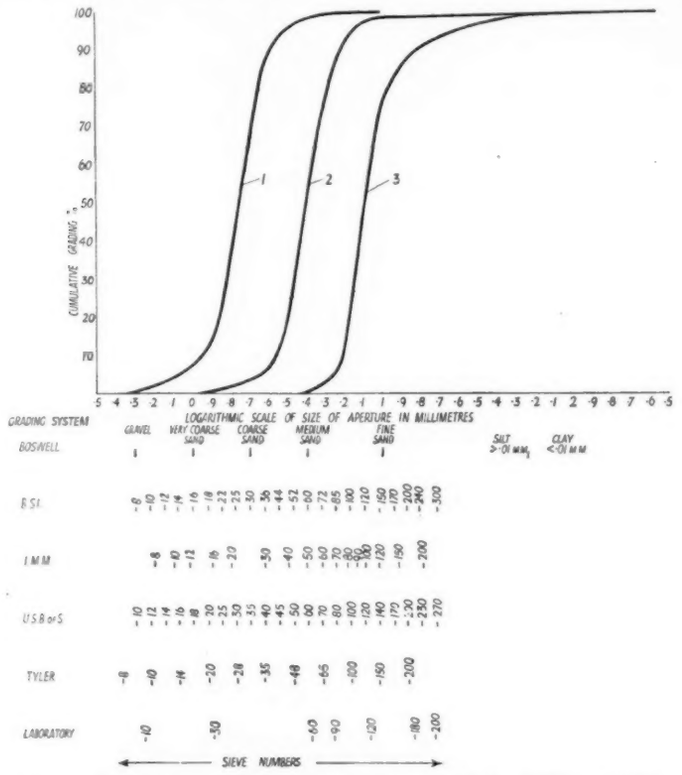


FIG. 4.—COMPARISON OF SIEVE NUMBERS SHOWN NUMERICALLY AND GRAPHICALLY.

for research work may be conveniently applied to foundry and supply control purposes. These sizes and their designations are as follow:—

Gravel ..	..	Above 2 mm. dia.			
Very coarse sand	Between	1	and	2	mm. dia.
Coarse sand ..	,,	0.5	,,	1	,, ,,
Medium sand ..	,,	0.25	,,	0.5	,, ,,
Fine sand ..	,,	0.1	,,	0.25	,, ,,
Silt	,,	0.01	,,	0.1	,, ,,
Clay ..	..	Less than 0.01 mm. dia.			

As already indicated, the clay in a moulding sand occurs largely as a coating surrounding each grain of sand, and to loosen this clay such a sand is boiled for about 10 min. in a solution of ammonia of about 2 per cent. concentration. After this, the grading is carried out by means of sieves with meshes of the appropriate sizes, down to the size of grain designated fine sand, while the silt and clay are removed in elutriators having two different rates of flow, the silt and clay being estimated by the weight carried off in each case by the stream of water.

It is unfortunate that so many different systems of particle classification are employed, since this makes it very difficult to compare the specified. Since the issue of the new B.S.I. specification for sieves, the I.M.M. have discontinued the use of their sieves as standards, but they are still being used fairly extensively. Other systems of sieving are also employed; for example, Girardet, in an article appearing in the "Bulletin de l'Association Technique de Fonderie" for July this year, used the following:—

Grade 1 ..	Less than	2	mm.	Greater than	1 mm.
,, 2 ..	,,	1	,,	,,	0.5 ,,
,, 3 ..	,,	0.5	,,	,,	0.25 ,,
,, 4 ..	,,	0.25	,,	,,	0.125 ,,
,, 5 ..	,,	0.125	,,	,,	0.1 ,,
,, 6 ..	,,	0.1	,,	,,	0.05 ,,
,, 7 ..	,,	0.05	,,	,,	0.01 ,,
,, 8 ..	Bond material.				

whilst Seger's original classification of grain sizes is as follows:—

Coarse sand	Greater than	0.33 mm.			
Fine sand	Less than	0.33 mm.	Greater than	0.04	mm.
Silt ..	,,	0.04 ,,	,,	0.025	,,
Rock dust	,,	0.025 ,,	,,	0.01	,,
Clay ..	,,	0.01 ,,			

The vertical ordinate indicates percentages which are cumulative, that is to say, the percentages of the different sized particles are progressively added, beginning with the largest sized particles, so that for any given size of aperture the percentage indicated is that of all particles greater than that size. If a sand consisted of particles all of the same size, the graph would be merely a straight vertical line drawn upwards

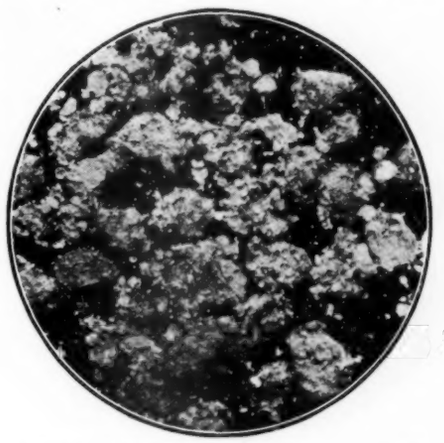


FIG. 5.—FACING SAND AS RECEIVED. × 30.

from the appropriate particle size, so that the more nearly the graph for a given sand approaches the vertical line, the more uniform is the grain size of the sand. Curves for three silica sands are shown on the graph.

No. 1 is a coarse silica sand and is Leighton Buzzard Sand No. 9.

No. 2 is a medium-sized silica sand from Chelford.

No. 3 is a fine-grained Ryarsh silica sand.

This method of plotting results is of value, since the results of different workers using different sizes of standard sieves can be plotted on the same graph and compared.

Media for Control

For control of foundry-sand supplies, therefore, the methods of test and the apparatus required are as follow:—

(1) *Chemical analysis* (including water content).—This can be carried out in any ordinary

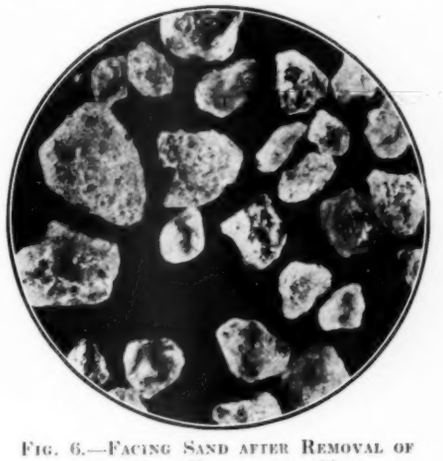


FIG. 6.—FACING SAND AFTER REMOVAL OF THE CLAY CONTENT. × 30.

chemical laboratory and calls for no further comment.

(2) *Mechanical grading.*—This is carried out with sieves of the sizes mentioned above, and with two elutriators for silt and clay respectively, and presents no particular difficulty.

(3) *Mechanical strength in the green state.*—Where a firm, whether a sand supplier or a sand user, is in possession of the A.F.A. standard per-

meability apparatus, this may conveniently be used to ram the specimen for determining the green compressive strength. Where this apparatus is not available, specimens in the form of cylinders either 2 in. by 2 in., or 2¼ in. long by 1⅛ in. dia., may be rammed by hand. In every case it is necessary to state the rammed density, and to give the water content. Whichever specimen is used, it is crushed on the pan of a spring parcels balance, as already described.

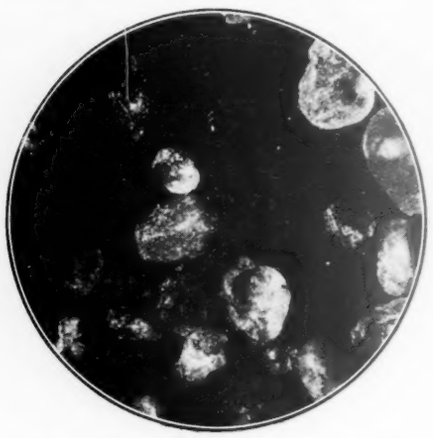


FIG. 7.—SILICA SAND FULFILLING THE REQUIREMENTS OF A STEEL FOUNDRY. × 30.

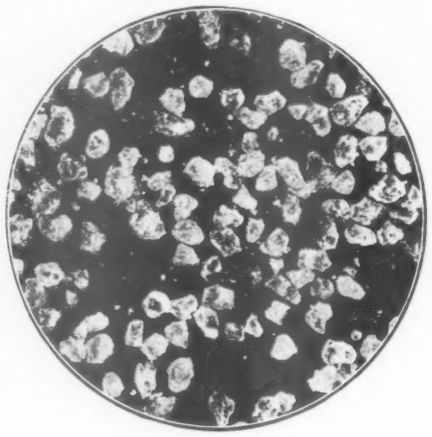


FIG. 8.—FINE-GRAINED SILICA SAND SUITABLE FOR SMALL CORE WORK. × 30.

FIG. 9.—COARSE-GRAINED SILICA SAND FOR GREEN SAND MOULDING WHERE IT IS PROPOSED TO MIX WITH BONDING MATERIAL. × 30.

(4) *Permeability.*—Again, where the A.F.A. standard apparatus is available, this is quite convenient to use. Firms not in possession of this apparatus, and not wishing to buy it on account of its high price, can use the apparatus illustrated in Fig. 3. This may be made up by the firm themselves, or it may be purchased complete from one or two firms specialising in such apparatus. The report of the test should indicate which apparatus has been used. It should also state the size of the test specimen and give the number of seconds required for two litres of air to pass through the specimen, together with the permeability number. With each type of apparatus there is provision for the use of a standard orifice. If this is utilised in the testing of the sand the result is given as a pressure of water, which in the case of the A.F.A. apparatus is in centimetres and in that illustrated is in inches of water. A sand laboratory thus includes apparatus for permeability by the A.F.A., B.C.I.R.A., and Richardson's apparatus, green crushing strength for both A.F.A. and B.C.I.R.A. specimens, and elutriators, all of which can be very compactly arranged. There is no need to suppose that a laboratory for testing sand occupies a very large space or that it costs a tremendous amount of money.

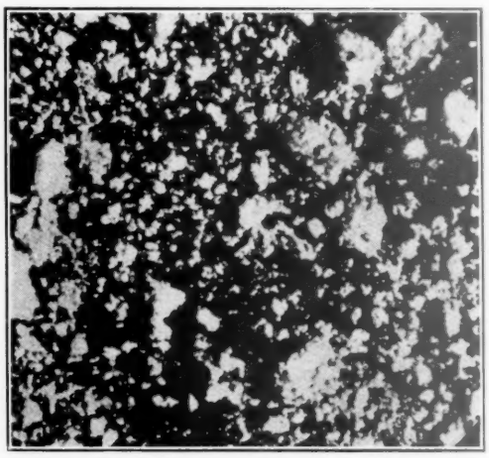


FIG. 10.—STRONG RAW MOULDING SAND WHICH REQUIRES MILLING BEFORE USE. × 30.

Typical Specifications

The sands purchased by a foundry may be roughly divided into three classes:—(1) Facing sand, already mixed and prepared, and supplied ready for use; (2) silica sand, which is used as such, bonded with oil or other core compound for the production of cores, and is also mixed (*a*) with the above facing sand to reduce its strength where this is considered necessary, and (*b*) with strong raw moulding sand which goes into the foundry unmilled (this must be milled and diluted with silica sand to form moulding or facing sand of the strength required for its intended purpose); and (3) strong raw moulding sand, either milled or unmilled, and unfit for use as received.

Facing or Moulding Sand Ready for Use

For a typical steel foundry, making moderate-sized castings of a minimum weight of, say, 14 lbs. or so, a sand complying with the following specification would give satisfactory results.

Chemical Analysis.—SiO_2, 89 to 92 per cent.; Al_2O_3, 4 to 6; Fe_2O_3, 1.5 to 4.0; CaO, 0.2 max.; and MgO, 0.2 per cent. max.

Mechanical Grading.

Coarse sand ...	5 per cent. max.
Medium sand ...	30 to 40
Fine sand ...	45 to 35
Silt	7 max.
Clay	12 to 16
Total sand grade	75 to 80 per cent.

Green Crushing Strength.—7 lbs. per sq. in. minimum, with a water content of 7.5 to 8.5 per cent., and at a relative density of between 1.8 and 2.0 gm./c.c.

Permeability.—In the A.F.A. apparatus, not more than 70 sec. for the passage of two litres of air, the water content being 7.5 to 8.5 per cent. The corresponding permeability number is 43, and this may be calculated equally well from results with the modified permeability apparatus.

In such a specification, the refractoriness of the sand is safeguarded by the silica specification, whilst the type and amount of bond are determined by the alumina and ferric-oxide in the chemical analysis, and by the clay content in the mechanical grading. The amount of silt is limited, as this contains only a small amount of bond, and is made up largely of very small sand grains which diminish the permeability. The size of the sand grains specified gives a reasonably open permeable sand, which, if properly used, will give no trouble in the foundry.

Fig. 5 illustrates a facing sand which is supplied ready for use, in the as-received condition. The grains are well covered with a layer of clay, and there is a certain amount of loose clay scattered in the background.

Fig. 6 shows the sand grains from the same sand after removal of all the clay. This sand would comply with the specification laid down above.

Silica Sands

(1) *Medium.* For use in a steel foundry, a silica sand to the following specification would be quite suitable.

Chemical Analysis—

Silica	97 per cent. min.

Mechanical Grading—

Coarse sand ..	8 per cent. max.
Medium sand ...	50 to 65.
Fine sand ...	45 to 30.
Silt plus clay ...	4 max.
Total sand grade	96 per cent. min.

Mechanical Strength (Permeability).—As this sand contains no bonding material it has no mechanical strength, and cannot be formed into a cylinder which is self supporting. The permeability is sufficiently covered by the specification of mechanical grading. These remarks apply also to the two silica sands which follow.

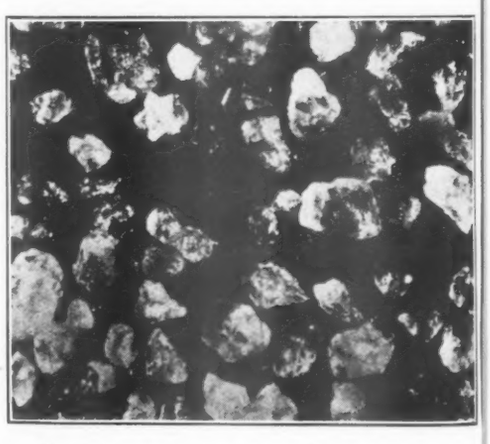


FIG. 11 SHOWS THE SAND ILLUSTRATED IN FIG. 10 AFTER WASHING. × 30.

Such a sand as this is very suitable for all kinds of core work met with in a steel foundry making moderate sized castings. It may also be used for mixing with the prepared moulding sand described above, when a mixed sand of lower strength is required. It is slightly coarser

in structure than the moulding sand, and will therefore give a mixture somewhat more open and permeable than the ready-mixed moulding sand, and will give a weaker facing sand which will prove quite satisfactory in service in cases where weaker facing sand may be used.

Fig. 7 illustrates a silica sand which would comply with the above specification. It is reasonably uniform in grain size, and some of the grain surfaces are rather rough, thus enabling a thin layer of binding material to attach itself more firmly to the grain surfaces than if the grains were perfectly smooth.

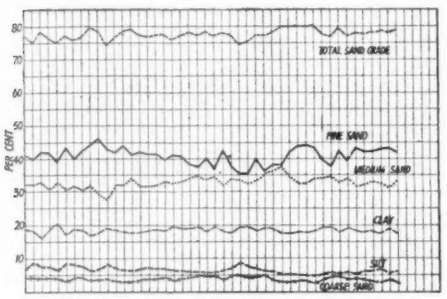


FIG. 12.—GRADING OF A FACING SAND AS SHOWING BY SAMPLES FROM SUCCESSIVE CONSIGNMENTS.

(2) *Fine.* For small core work and small castings weighing a few ounces or a pound or two, where the quality of the surface is of importance, a sand complying with the following specification is suitable. For both cores and moulds it is mixed with a core compound and dried in the core oven.

Chemical Analysis—

Silica	97 per cent. min.

Mechanical Grading—

Free from gravel and coarse sand	
Medium sand ...	1 per cent. max.
Fine sand ...	75 to 85.
Silt and clay ...	25 to 15.

Fig. 8 illustrates a fine-grained silica sand which would comply with the above specification, and which is frequently used for the purposes mentioned. In both this and the previous sand the "clay" is not actual clay, but consists simply of very small particles of silica. An actual content of clay, except in very small amounts, is guarded against by the chemical analysis specification of 97 per cent. silica as a minimum.

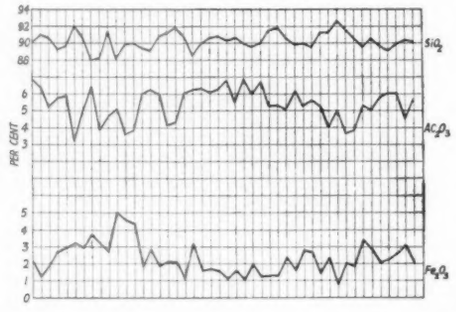


FIG. 13.—CHEMICAL GRADING OF A FACING SAND AS SHOWN BY SUCCESSIVE DELIVERIES.

(3) *Coarse.* For green sand work, a very permeable silica sand is sometimes mixed with fire clay, ball clay, or Bentonite to give a highly permeable facing sand, in order to avoid scabs and blow-holes in the castings. A suitable specification for silica sand of this nature is as follows:—

Chemical Analysis—

Silica	97 per cent. min.

Mechanical Grading—

Gravel	2 per cent. max.
Very coarse sand	8 per cent. max.
Coarse sand ...	50 to 60.
Medium sand ...	40 to 30.
Fine sand ...	3 max.
Silt plus clay ...	1 per cent. max.

Fig. 9 illustrates a coarse-grained silica sand of this type which would comply with the above specification.

Of the two sands last considered, the first one will have as high a permeability as is reasonably possible for a sand of such a fine grain, and is suggested for small work only. The second sand, with its very large grain size, provides a very permeable green sand which is suitable for any heavy casting up to the largest which can be made in green sand, but which is not suitable for very small work, as the surface of the castings is rougher than the surface demanded in small work.

Strong Raw Moulding Sands

Sands of this nature come into the foundry unmilled, in that state possessing little bond, or milled, when they become very strong, being unfit for use as received. They are used as raw material from which facing or moulding sands of different strengths may be produced, by mixing them with silica sand. The amount of silica sand which must be added to produce a moulding sand with particular properties naturally depends on the amount of bonding material present in the raw moulding sand. It is possible, therefore, to have a series of such sands of varying constitution which would all give satisfactory service in the foundry when mixed with different amounts of silica sand to the same amount of raw moulding sand, for a resulting mixture having approximately the same properties in each case. Here, therefore, assuming that the actual grain size of the sand grains is satisfactory, the value of the sand to a foundry depends largely on the clay content and to a less degree on the silt content, as the amount of clay present is the chief factor in determining how much the raw sand can be diluted with the cheaper silica sand. One suitable specification for such a sand would be as follows:—

Chemical Analysis.—Silica, 85 to 88 per cent.; Al_2O_3, 5 to 9; Fe_2O_3, 3.5 to 5.5; CaO, 0.4 max.; and MgO, 0.4 per cent. max.

Mechanical Grading.

Very coarse and coarse sand ...	10 per cent. max.
Medium sand ...	20 to 35
Fine sand ...	45 to 30
Silt	15 max.
Clay	20 to 25
Total sand grade	65 to 75 per cent.

Green Crushing Strength.—12 lbs. per sq. in. minimum for a relative density of 1.9 gm. per c.c., and 15 lbs. per sq. in. minimum for a relative density of 2 gm. per c.c., with the water content at its optimum value.

Permeability.—With the A.F.A. apparatus not more than 120 sec. for the passage of 2 litres of air, the water content being the same as in the previous test. The permeability number corresponding is 25, and this may be obtained equally well from the modified permeability apparatus.

Before such a sand can be tested in the above way it must be milled, unless it has been milled before delivery. This may be done by hand, in a mortar, or more conveniently and better in a small hand mill. The reason for quoting no definite figure for the water content is that these sands develop their maximum strength at water contents which may be substantially different with different sands, according to the type of bond, high-alumina bonded sands requiring more water than high-iron-oxide bonded sands. A definite figure for water content could, however, easily be fixed for any particular bed of strong moulding sand.

An alternative method of controlling the supply of such a sand would be to demand that a given amount of it, milled up with a specified amount of a silica sand of a particular grain distribution, would give a facing or moulding mixture having the properties indicated in the specification already described for facing or moulding sand ready for use.

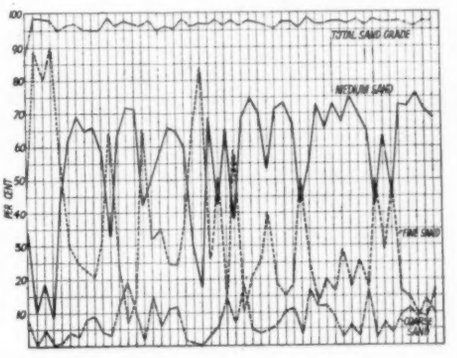


FIG. 14 SHOWS THE RESULTS OF GRADING FIFTY SUCCESSIVE DELIVERIES OF SILICA SAND.

Fig. 10 illustrates a strong moulding sand which would comply with the above specification. The grains are covered with clay and there is much additional clay loose and available for coating the surface of other grains. Fig. 11 illustrates the silica grains of the same sand which have been washed free from clay. They are reasonably uniform in size.

The above specifications are by no means exhaustive, as it is quite possible to use other sands with different properties in a steel foundry, but they represent typical sands which are extensively used in this country, and a steel foundry could make good castings if it were supplied with no other sands than those specified. The specifications are not difficult to meet, and there are many sand-supplying firms in this country which would have no difficulty in supplying sands to comply with the specifications. In actual fact, the specifications do not cover every one of the properties which influence the behaviour of sand in a foundry, but the addition of other tests covering other properties could be made when sufficient experience had been gained in purchasing sands to the requirements of the specifications already outlined.

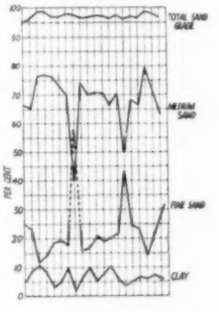


FIG. 15 SHOWS THE MORE RECENT VARIATION OF TWENTY DELIVERIES OF SILICA SAND.

Results of Testing Consignments of Sands

Following on the above account of suggested sand specifications, it is now proposed to show how in some cases the properties of successive consignments of ostensibly the same sand vary. Fig. 12 shows the mechanical grading of a facing sand which is supplied to foundries ready for use, and indicates the distribution of grain size

(*Concluded on page* 328.)

International Foundry Congress

DESCRIPTIONS OF SOME OF THE WORKS VISITS

(From Our Special Correspondent)

The pre-Convention tour which preceded the recent International Foundry Convention in Philadelphia was arranged to take in a number of industrial cities. At each city a choice of visits was offered from a list of local foundries, so that each member of the party was enabled to spend his time mainly in visiting the type of foundry in which he was most interested. Some foundries attracted only a few visitors, while others of more general interest were visited by the majority of the overseas party. Your correspondent endeavoured to avoid specialisation in his choice of visits, and arranged his inspection so as to cover a variety of foundry operations and products.

Much more time than was available could have been spent profitably in every one of the plants. In every case our hosts placed themselves and their staffs freely at our disposal and endeavoured to impart to us as much information as possible and to show us as much detail as the limited available periods allowed. We are greatly indebted to all the companies concerned and to their respective managements and staffs for their courtesy and for the open and generous manner in which they showed us their plants and discussed with us their experiences.

As was expected, we found that, wherever possible, castings are made on a proper manufacturing basis, every operation being mechanised as far as possible. The conveyor system of mechanised foundries is employed extensively, and coremaking and moulding are carried out in these foundries almost exclusively by mechanical methods. The amount of money invested in moulding and coremaking equipment for individual castings made in some of the automobile plants is staggering. A continuous flow system is frequently used for core drying and for annealing, continuous ovens and stoves being commonly employed for these processes. In several foundries electric furnaces are used for metal melting, either alone or in conjunction with cupolas as a duplex process.

We purposely visited several foundries whose product by reason of the small quantities required does not permit of complete mechanisation. In such foundries the general lay-out and the methods of working are not unlike those in use in similar foundries in Great Britain, with the exception that the American foundries tend to make greater use of mechanical appliances of general utility, such as mechanical riddles, pneumatic rammers and chippers, and hydraulic cleaning of large castings. Sandslingers are used extensively, in the large general foundries for ramming up large work and in the purely mechanical foundries for ramming up moulds made on batteries of small moulding machines. Considerable attention is given to safety clothing, almost every man who is concerned with the handling of hot metal being provided with suitable protective clothing. Our American friends do not hesitate to spend money on equipment.

The foundry buildings which we saw were all comparatively modern, as is to be expected in a country whose industry has expanded so greatly within two or three decades. The buildings are light, and "good-housekeeping"—the policy of cleanliness, and tidiness—is almost a fetish, and with very satisfactory results. Working conditions in some of the mechanised foundries do not appear to the casual observer to be particularly pleasant, but we are prepared to accept the assurance given to us repeatedly that these conditions are not nearly so onerous and unpleasant as they appear, and that the men soon become accustomed to them.

There is constant medical supervision and works hospitals and first-aid stations are lavishly equipped. Most of the larger foundries have extensive installations of changing rooms and baths, and we understand that these facilities are used by a large percentage of the employees.

Facilities for meals are not on the same elaborate scale as in Great Britain. Many plants have dining rooms for the managers and staffs, and some plants operate cafeteria or shops where light refreshments may be obtained by the workers, but we did not see many of the large and completely equipped canteens which are now such a prominent feature of industrial life in this country. Large numbers of workers partake of their mid-day meal in the workshops.

Worthington Pump and Machinery Corporation, Buffalo

The Buffalo plant of the Worthington Pump Corporation was the first to be visited. This company manufactures pumps, air compressors and gas engines, and normally about 1,000 people are employed. The variety of designs and sizes of the products is considerable. The quantities of some of the products, whilst not sufficiently large to permit of so-called mass production methods, are sufficient to permit of a certain amount of repetition work in the machine shops and the foundry, and quantity production methods are employed as far as possible.

We have no figures of the dimensions of the foundry, but we would describe it as a medium-sized general foundry producing fairly heavy castings, such as compressor and gas-engine bedplates, cylinders, etc. Jolt-ram turnover-type moulding machines are extensively employed, the final ramming on the top of the mould being given by pneumatic rammers. We observed a crew of four men ramming up moulding boxes, 5 ft. by 3 ft. by 2 ft. deep. The total time taken to ram up each box was approximately 1 min., and six complete moulds of two boxes each are rammed up in 1 hr. This includes the time occupied in placing the box, withdrawing the pattern, making runners and all incidental operations.

There are two cupolas, 56-in. and 54-in. internal diameter respectively, capable of melting up to 120 tons per day. In most of the mixtures, at least 30 per cent. of steel is used. Hydraulic cleaning of large castings is employed, and is said to give quite satisfactory results. We observed a cylinder casting, of perhaps 2 tons weight, the whole of the cores of which were completely removed in about 7 min.

Allis-Chalmers Manufacturing Company, Milwaukee

This immense factory is engaged in the manufacture of a large variety of heavy machinery, including steam and water turbines, pumps, large gas engines and machinery for a number of miscellaneous industries. The ironfoundry is an immense building, 1,100 ft. long, lofty and with ample crane power. The cupolas are capable of melting 200 tons per day. Although not by any means a repetition foundry, repetition methods are employed wherever possible. Tractor parts are produced in large quantities, and are made on moulding machines in conjunction with a conveyor for assembly of the moulds, casting and cooling. Special core-making and core-drying equipment has been installed for this work, the whole plant being very well designed and intelligently planned. Large castings, such as gas-engine bedplates, etc., are made in four large pits, and ramming is carried out by what is claimed to be the largest Sandslinger in existence—and we believe it. It is an immense piece of apparatus.

Hydraulic Fettling

Hydraulic cleaning of large castings has been developed extensively, and is carried out in a steel chamber, 50 ft. long, 44 ft. wide and 24 ft. high. The casting to be cleaned is placed on a large turntable in the centre of the chamber, the doors are closed, and a stream of water at 400 lbs. per sq. in. pressure is directed on to the cores. The operator is situated in a control room outside the large chamber and observes the progress of the work through a window. The motions of the turntable and the direction of the water jet are under his control. The speed with which the hard cores are broken and the sand removed from the casting is amazing. Half-an-hour was the time given for the complete removal of all the sand from a complicated baseplate casting which we saw, and which was several tons in weight. We were informed that the cleaning time of one large casting made by the company has been reduced from 144 man-hours to 4 man-hours. The plant is operated by two men only.

A non-ferrous foundry is in operation, coke-fired pit furnaces being mainly employed. There is also an extensive pattern shop. Steel castings are purchased from outside foundries. A walk through the vast machine and erecting shops showed the variety of large castings produced by the company, and also showed an interesting display of steel castings made by their suppliers.

At present the company is constructing four water turbines, each of 115,000 horse-power, for the Boulder Power Plant—a huge hydro-electric scheme on the borders of Colorado. The immense cast steel spiral casings are impressive examples of the steel founders' art. Each casing weighs about 200 tons and consists of six castings. Not only are these castings large and heavy, but they are very complicated and intricate in design, and their successful manufacture reflects great credit upon the steel founders, the Falk Corporation of Milwaukee.

Our visit to this plant was under the guidance of Mr. A. E. Harrison, General Superintendent, who served his apprenticeship in England, and Mr. R. S. McPherran, who is well known in British foundry circles.

The Harnischfeger Corporation, Milwaukee

The Harnischfeger Corporation celebrates its fiftieth anniversary this year. It commenced its career by manufacturing knitting machinery, but soon developed a vastly different type of product, and for many years has been famous as one of the largest firms engaged in making overhead cranes and excavators of all types. Electric welding plant of all kinds is produced, and the company makes the electric motors and switchgear used in its own products and also for outside sales. About 2,500 persons are employed.

A considerable proportion of welded structures are used in the company's products; nevertheless, welding has not displaced castings by any means. Steel castings (which are purchased from outside foundries) are employed extensively, and considerable quantities of iron castings made in the firm's own foundry are in use. Although manufacturers of welding equipment, the company endeavours to keep an open mind in selecting either castings or weldings for a given purpose.

The ironfoundry is not a large one and owing to the wide variety of castings produced it is not possible to employ quantity-production methods to any considerable extent. Moulding machines are used when possible and numerous mechanical aids to hand work are employed, such as mechanical riddles and pneumatic rammers. There are two Whiting cupolas of 42 in. and 60 in. dia. respectively, and about 200 tons of iron per week are melted in normal times. Hand

charging is employed, being preferred to mechanical charging for cupolas of a comparatively small size. A small electric furnace is also used as part of a duplexing process.

As in other American general foundries, wood flasks are largely used for jobbing work on account of cheapness and ready adaptability to patterns of a variety of shapes. Pressed-steel flasks are used for work of a standard character. In the extensive erecting shops were excavators of all types and sizes for every conceivable service required by contractors. The company has developed a boom or jib of duralumin built up in sections, and buckets of a light-weight aluminium alloy are also being manufactured. We also observed four overhead cranes destined for the power house at Boulder Dam. Each of these cranes has a span of 64 ft. and a lifting capacity of 300 tons.

Your correspondent was the only member of the party who selected this works, and he is particularly pleased with his choice, and is grateful to Mr. F. Salditt, the company's export manager, who was his host.

Ford Motor Company

Although a day was spent in the works of the Ford Motor Company, it was impossible to obtain more than a superficial glimpse of this huge factory. Although a considerable proportion of the available time was spent in the foundries and steelworks, we felt that many visits would be required fully to understand the many unique and frequently unorthodox operations.

The foundry covers about 30 acres and it is said that 2,900 tons of castings can be produced in 24 hrs., presumably by shift working. As automobile production is usually slowed down in the autumn, pending the release of new season's models, the foundry was not working the full number of shifts at the time of our visit.

As is well known, the conveyor system is adopted for every possible operation in this foundry, separate conveyors each with its own batteries of moulding machines, pouring and sand-conditioning unit being employed for each important casting. All cores are of artificially-bonded silica sand (the term "oil sand" only appears to be used when the bond is actually an oil). A unique development is the casting of the new V8 cylinder block and upper half crankcase in one piece. Forty-eight cores are required in each mould.

The foundry operates 32 cupolas, whose melting capacities vary from 4 tons to 15 tons per hr. The general principle seems to be to use molten pig-iron from the blast furnaces on the plant and to use the cupolas for melting steel and iron scrap, the latter consisting largely of runners, etc. Mixing is carried out in mixers or in electric furnaces, of which there are several of varying capacities.

Considerable interest has been aroused by the cast crankshaft of the Ford V8 model. This is often described as a cast-iron crankshaft; the metal, however, approximates in composition to a cast steel, the composition being given as follows:—Carbon, 1.25-1.40; manganese, 0.50-0.60; silicon, 1.90-2.10; chromium, 0.35-0.40; copper, 2.50-2.75; phosphorus, 0.10 per cent. max., and sulphur, 0.06 per cent. max.

At present we understand this metal is prepared in two 15-ton electric furnaces, the charge consisting of 40 per cent. steel scrap, the balance being pig-iron, returned scrap and alloys, but a duplexing system of cupola melting and air-furnace refining is being developed.

The moulds are built up entirely of cores. Each mould forms four cast crankshafts, and is built up of 16 cores. Elaborate core-making plant on the conveyor principle has been developed, and baking is carried out in vertical continuous core ovens, the baking operation occupying 1 hr. 20 min. Cores are inspected, levelled and silica washed on a conveyor, and a conveyor is used for storage. Assembly of the moulds and casting is also done on a conveyor.

The cast crankshafts are normalised by heating to 895 deg. C. and cooled to 538 deg. C., this cycle taking 1½ hrs.; they are then heated again to 760 deg. C. for 9 min. and cooled to 370 deg. C., this operation taking 2 hr. They are then air cooled to normal temperature.

Some of the advantages claimed for the cast crankshaft against the forged shaft are:—(1) It is about 10 lbs. lighter, because the crank-pin journals are cored; (2) the forged shaft weighed 90 lbs. rough and 66 lbs. finished; the corresponding weights for the cast shaft are about 65 lbs. and 56 lbs. respectively; (3) there are 54 machinery operations, against 62 in the forged shaft; (4) the cast shaft is expected to be superior in service, tests showing measurable wear on the forged shaft after 10,000 miles with no appreciable wear on the cast shaft; and (5) a nearly uniform Brinell hardness throughout the casting, resulting in exceptional fatigue strength.

The Ford Company is rapidly becoming self-supporting with regard to raw materials. There are two blast furnaces, a battery of coke ovens, and all steel, with the exception of sheet steel, is made in the works. Mills for rolling sheet steel are in course of erection. The company owns its own supplies of coal, ore, limestone, timber and nearly everything else.

The steelworks contains two 800-ton mixers, one 400-ton open-hearth furnace, and nine 100-ton open-hearth furnaces. The fuel is coke-oven gas; when supplies are short, tar is used as fuel, and oil fuel can be used as a standby.

As all the sections which are rolled are comparatively light, round ingots of only 2,000 lbs. weight are cast, four ingots being poured at once.

A feature of the steelworks and rolling mills is the cleanliness and tidiness. Every piece of scrap or dirt is cleaned up at once, the floors are washed down daily, the ironwork of the furnaces and of every piece of plant is continually painted, and all bright parts are polished regularly. The buildings are light, clean and entirely enclosed, and the whole plant resembles a well-kept power station rather than a steelworks.

Eaton-Erb Foundry Company, Vassar

A very interesting works is that of the Eaton-Erb Company, of Vassar, Michigan. This company, which is under the direction of Mr. Fred Erb, Past-President of the A.F.A., specialises in the quantity production of very small castings for the automobile and refrigerator industries. In the sand foundry melting is carried out in two electric furnaces of 6,000 lbs. and 400 lbs. capacity respectively. When production warrants, cupola melting is employed, the electric furnaces being used for refining. Some idea of the output numerically may be gained from one example which we saw being manufactured. The casting was a small disc about one inch in diameter. Twenty-four patterns are mounted on a plate and the moulds are cast in stacks 14 moulds high. About 20,000 castings are produced from this pattern per day.

The Eaton-Erb Company has now acquired the rights of the Holly Carburettor Company, and in the foundry at Vassar there are eight rotary casting machines for producing castings in permanent iron moulds. Each unit is provided with twelve heads or permanent moulds, and the process is continuous and automatic. Before the moulds are placed on the machine they are heated to about 150 to 250 deg. C. and are given a thin coating of refractory wash which may be applied one or more times per day. Additionally, the faces of each mould are carbon coated with an oxy-acetylene flame after each cast, this operation being carried out automatically. As a given mould passes the pouring station, the metal is poured into the mould and it solidifies at once, cooling being facilitated by a large number of pins cast on the back of the mould, which provide a large cooling surface. As the mould passes on it gradually opens, the castings are ejected, then the mould travels through a hood, in which the smoking by oxy-acetylene flame is carried out. On emerging from the hood, cores are set in the mould, which gradually closes before it arrives again at the pouring station. The usual speed is about 3½ min. per revolution, the whole of the twelve moulds on the revolving machine having been poured in that time.

The moulds are approximately 2 in. thick and are about 20 in. by 18 in. in size. The number of castings on a mould may be one to 16, according to size.

The moulds are of cast iron of the same composition as the castings themselves, viz., 3.50 per cent. total carbon, and 2.60 per cent. silicon.

After removal from the moulds, all castings are annealed in an oil-fired furnace at 816 to 970 deg. F. for from 15 to 25 min. About 75 tons per day are cast in this foundry, and the output numerically has been as high as 2,000,000 castings per month. A very modern tool-room is in operation for the construction of the moulds. We were fortunate in having the guidance of Mr. Fred Erb himself in our tour of this unique foundry.

Saginaw Malleable Iron Division, General Motors Corporation

This immense foundry is situated at Saginaw, Michigan, about 100 miles north of Detroit, and is engaged exclusively on the production of black-heart malleable castings for the various factories of the General Motors Corporation. Approximately 550 tons of metal are melted per day. The total output of actual castings is about 63,000 tons per annum, about 45 per cent. of the metal cast being runners and risers, which are, of course, remelted. In discussing annual outputs of American plants, it should be remembered that their weekly hours are limited under the N.R.A. Codes, and the working week is therefore shorter than in Britain.

Metal is prepared by a duplex process, consisting of cupola melting and refining by electric furnaces.

Moulding and coremaking are carried out on conveyors, the general practice being similar to that in all the large automobile foundries.

There are eight separate conveyors engaged in different classes of work. Most of the moulding machines are of the squeeze-turnover type.

Annealing of the castings is carried out in continuous annealing ovens, 360 ft. long, at a temperature of 1,730 deg. Fah., the annealing time being 50 hrs. The fuel used in these ovens is natural gas. No packing is used. After annealing, all castings are straightened by placing them in jigs, and pressing them to their proper shape in mechanical presses, a battery of such presses being in use.

Our guide at this foundry was Mr. D. O. Thomas, the general manager, who was chairman of the Rotary Club luncheon we attended earlier in the day.

Chevrolet Grey-Iron Foundry, General Motors Corporation, Saginaw

The grey-iron foundry of the General Motors Corporation is engaged on castings for Chevrolet cars. It is situated at Saginaw, a mile or two from the malleable foundry, each foundry being a self-contained unit.

The melting plant consists of 11 cupolas, most of which have an internal diameter of 90 in., and the normal melt is about 2,000 tons per day; 2,200 tons have been melted in a single day. At the time of our visit, production was slowing down pending the advent of the new models, and about 1,200 tons was melted on this particular day.

Iron, coke and other raw materials are brought by steamer on the Great Lakes up the Saginaw River to the foundry's own dock on the plant. As these waters are frozen during the winter months, it is necessary to accumulate stocks each autumn, and at the time of our visit, 65,000 tons of machine-cast pig-iron were stored on the

wharf. As would be expected, the appliances for unloading and storage are of an elaborate character.

The cupolas are charged mechanically, and each cupola has two charging doors, one at each side. Iron enters at one side and coke and limestone at the other. All charges are automatically weighed.

Practically no new sand is bought for moulding purposes, the company having developed a synthetic sand consisting largely of waste sand from the foundry. Oil-sand cores are used extensively, the sharp sand for the cores being taken from the bed of the Saginaw River. This procedure performs the additional function of dredging the river at the same time. There are two self-contained coremaking departments, one on each side of the foundry. In each of these core shops there are batteries of grinding wheels used for grinding cores to size. Even the minor operation of initial assembly of small cores engages a considerable staff of female labour.

The making of the moulds is carried out on 14 conveyor lines, each one a self-contained unit. Three of these lines are engaged on cylinder blocks, the remainder on various other types of castings. After being knocked out of the moulds, the hot castings travel back and forward on a chain conveyor until they are cool. Most of the moulding machines are of the squeeze-turn-over type.

Unlike many similar plants, this foundry has elaborate mess-rooms or cafeteria. There are extensive and extremely well-appointed washing and changing rooms, and there is an elaborate system of medical examination and a well-equipped works hospital.

The two General Motors foundries were among the most impressive we inspected, not only because of their vast outputs and huge dimensions, but in both foundries there is an absence of crowding of men and apparatus, and the work proceeds systematically step by step. Both foundries are light and clean, considerable attention is paid to the removal of dust and fumes, and some of the departments, particularly the coremaking departments at the grey-iron foundry, are models of industrial establishments at their best.

Damascus Bronze Company, Pittsburgh

The Damascus Bronze Company at Pittsburgh is a comparatively small plant, dealing as it does largely with comparatively small bronze castings; it is, however, a well laid out, well managed concern, and possesses several features of unusual interest. The principal lines of manufacture are bronze bearings for rolling mills and bearings for railway freight car bogies. As these castings are manufactured in large quantities, moulding operations are carried out on the conveyor line system, a comparatively simple type of roller conveyor being employed. Moulds are made on jolt-squeeze machines, the squeezing motion being used finally after the mould has been rammed by jolting. The rolling mill bearings are made one in a box, the freight car bearings two in a box.

A novel feature of this foundry is that the bronze for the bearings is cupola melted, two small cupolas being used for this purpose. We understand that the general principles of operation are similar to those employed in melting iron, although there are minor differences and certain small precautions have been found to be necessary. Temperatures are lower, and less coke appears to be required. The composition of this metal was given as: Copper, 70 per cent.; lead, 23 per cent.; tin, 7 per cent.

In addition to the manufacture of bearings, the company is engaged in general brass and bronze founding, metal for this work being melted in crucible pit furnaces.

Mesta Machine Company, Pittsburgh

This company manufactures steelworks plant, particularly rolling mill equipment and rolls of all descriptions. Iron and steel castings are made, and steel castings of 250 tons each have been produced. In various parts of the works we observed many cast steel rolling mill housings of the order of 70 tons weight.

Iron for roll making is melted in four, 20-ton air furnaces, coal-fired. Steel is made in open-hearth furnaces. A large battery of coke-fired drying stoves is employed for drying moulds and cores. They are all fitted with recording pyrometers, which record the temperature at various parts of the stoves, and the system of flues is such that remarkable uniformity of temperature is attained. Very large moulds are dried *in situ* by natural gas.

In a foundry of this type it is impossible to proceed on mass-production lines, but considerable use is made of mechanical auxiliary appliances. The lifting appliances are impressive; in one bay alone there are nine overhead cranes, one with a lifting capacity of 125 tons.

Moulding methods in general are similar to those adopted in British foundries of the same type. The company has extensive machine and erecting shops, many of the machine tools being of special design and of very large dimensions. It was pleasing to see that in spite of the depression in the steel industry that this company is fairly busy, and was engaged in several orders for steelworks plant of considerable magnitude.

The Testing of Steel Foundry Sands, and the Control of Supplies by Specification

(*Concluded from page* 325.)

in 46 successive consignments of the same sand from the same supplier. It will be noticed that all the consignments give very similar results, and that the sand is reasonably uniform throughout the whole period. Fig. 13 shows the chemical analysis of the same sand as determined from the same consignments. The analysis is not quite so uniform as the grading, but it is still reasonably satisfactory. It will also be observed that nearly all the consignments would comply with the specification already laid down for such a sand.

Fig. 14 illustrates the mechanical grading of 50 successive consignments of a silica sand, all from the same supplier, and all supposed to be of the same sand. In this case it will be observed that successive consignments vary widely in the distribution of grain size. These differences caused considerable difficulties in the foundry, as sand of such varying properties could scarcely be expected to behave in a uniform manner when successive supplies were treated in the same way.

Fig. 15 shows the results of examination for mechanical grading of 20 successive more recent consignments of the same sand as Fig. 14. Here it will be observed that the consignments are very much more uniform in their properties. Apart from two unfortunate lapses, nearly all these consignments would comply with the specification already described for such a sand. This considerable improvement is due very largely to the fact that the supplying firm were notified that every consignment was being examined, and were given information regarding results of the examination for their guidance. With nearly all of the sand covered by Fig. 15, no difficulty would be experienced in a foundry if different consignments were treated in the foundry in exactly the same way.

Advantages of Specifications for Foundry Sands

There is no doubt that if the control of supplies of foundry sand were in the main covered by specifications, the system would be a great improvement on that now in vogue, and would be advantageous to everybody concerned.

To the foundries, such a system would ensure supplies of sand of known properties, and in addition would means that successive consignments could be relied upon to give just the same results when treated in the same way each time. This would be a great help, and if the sand were really uniform, it would dispose of a good many excuses for bad work. In the case of supplying firms wishing to supply trial sands, it would be easier for the foundry management to say either: "This is the specification to which our sand is supplied, send some to comply with it," or "These are the properties which we should like a sand to possess. Can you supply such a sand?" In addition to this, if the properties of different kinds of sands were well known throughout the trade, so that any foundry could detail the properties of the sands which it used or desired to use, this would promote a healthy spirit of competition between suppliers of foundry sands, who would have a good idea beforehand of the type of sand to supply to a foundry, instead of as at present supplying a foundry with a sand which the supplying firm knows has given good results in one foundry, and therefore believes ought to be equally suitable for another foundry.

To the sand seller supplying to specification would be an assurance beforehand that a foundry would be satisfied with the sand it received. Examination of its own sand to ensure that it complied with the specification would also give an early warning to the selling firm when the character of its sand, as excavated or otherwise obtained, began to change. It would also be easy to quote for a supply of sand to fresh foundries if the specifications required for such sands were well established.

A further advantage to the supplying firm would be that by testing its own sands according to established methods it would soon obtain a knowledge, expressed quantitatively, of the various properties of the sands obtained by mixing sands of different kinds in specified proportions, and this would make it very easy to supply ready-mixed sands with slightly different properties to suit the requirements of individual foundries.

In short, the establishment of routine sand testing by agreed methods and the control of foundry sands by specification would not only enlarge the knowledge of those engaged in the foundry industry and in the refractories industry regarding the properties of sands of all kinds, but would also be of considerable benefit to the industries concerned, as it would put the purchasing and using of sands on a far sounder and much more satisfactory basis than the trial and error system which has been so common hitherto.

Iron and Steel Output in October

The British Iron and Steel Federation states that there were 97 furnaces in blast at the end of October, compared with 98 at the beginning of the month, two furnaces having been blown in and three having ceased operations during the month. The production of pig-iron in October amounted to 527,100 tons, compared with 500,300 tons in September and 373,300 tons in October, 1933. The production includes 131,700 tons of hematite, 267,200 tons of basic, 112,500 tons of foundry and 7,300 tons of forge pig-iron. The output of steel ingots and castings in October amounted to 812,000 tons, compared with 734,700 tons in September and 668,300 tons in October, 1933.

Nickel Cast Iron Grain-Grinding Plates

Research carried out by the Hydro-Electric Power Commission of Ontario, in connection with increased application of electric motive force to agricultural machinery, has resulted in the development of an improved type of grain-grinding plate which is reported to be giving highly satisfactory results. The new model is toothed, and grinding is achieved by shear (in place of the rubbing action formerly employed), necessitating the use of a metal which is hard, resistant to wear and free from any tendency to warp in service. Ni-Hard (nickel alloy cast iron) is found to have all the properties required for this arduous class of service.

XUM

Foundry Training

MR. WALKER'S PRESIDENTIAL ADDRESS

At the opening meeting of the West Yorkshire Branch of the Institute of British Foundrymen, held at the Bradford Technical College, Mr. A. W. Walker, of Messrs. Thomas Broadbent & Sons, Limited, Huddersfield, entertained the members of the Branch to tea, and subsequently delivered his presidential address. The address was followed by a general discussion on the subject of moulding sands, opened by Mr. F. K. Neath, B.Sc. (Vice-President).

MR. WALKER, in his address as the new President, said he felt himself singularly honoured as a comparatively new-comer to the Branch. The significance of a successful foundrymen's organisation in a district whose membership was so widely scattered, covering so great an area and centralised in the hub of an alien industry, did not impress him until he became a member of the Branch. The work done by the original officers, and perpetuated by their successors, must have been begun in optimism, and the result, as they well knew, had been a splendid tribute to their labours. Those labours, initiated in a year which marked a beginning of trade decline, and carried through a period of acute depression in the foundry industry, had been the means of banding together a collection of men whom he claimed were among the ablest foundrymen in the Institute. The West Riding Branch was not noted for its academic outlook so much as for its practical qualities, but probably in the future the balance would be adjusted more evenly, no doubt to the benefit of the whole work. One thing more than any other, perhaps, which had contributed to the successful work of the Branch was the spirit of good-fellowship which prevailed. It had been the means not only of a free exchange of ideas, but of the development of warm friendships.

The work of the various sub-committees of the Institute, proceeded Mr. Walker, could not at this close date be fully appreciated, but would assume its truly great value as time advanced, and the results of the various findings began to take their place in the everyday practice of the foundry. This year the work of the Sub-Committee on Sands and Refractories would be of special interest, as their programme necessitated the co-operation of a few hundred foundries throughout the country.

The Progress in Sand Preparation

"Sand," said the President, "as a study is very much to the fore in the light of recent published developments, and the development of a single base sand without the use of, or with the restricted use of, new sand to supply the bond, is bound greatly to interest all foundrymen. As research progresses, we find that in every activity in the foundry, as the cupola has proved, and sand is proving, close control methods deserve and command success. The foundry industry is one in which whatever changes are made must be made with due deference to the human factor. In no industry is this factor more important. As an example of this we may take a sand mixture. If such a change be contemplated, the new substance must be as much like the old as possible. To the moulder it must have the same feel and the ability to finish off as before. The properties he appreciates must still exist, otherwise the confidence of the operator will be destroyed, and without doubt the results which follow will, to say the least, be very unsatisfactory. This development in sand practice is one of the results obtainable from scientific research, and the foundry owes a great deal to the men who work on the scientific side of the industry, as all real progress has without a doubt been made as a result of their investigations.

The Rôle of the Scientist

"At the same time (continued Mr. Walker) the foundry, when co-operating with the scientific side, wants to find the scientist a person who has an essential knowledge and understanding of foundry conditions. Scientific knowledge, to be of any use in the foundry, must be applied by people having this understanding, and be accepted by the foundry with the correct appreciation of the requirements of foundry progress. Results which should have accrued have very often been destroyed by the foundryman with the obstructive mind. The attitude of refusing deliberate discussion by outside interests is a definite brake on foundry progress. To every subject there are two sides. The scientific side, to be of any use to the foundry, must come to our problems with some knowledge of the meaning of foundry practice as it exists in the foundry, and not as it is found in a text-book. The scientist must bear in mind that under no possible conditions is foundry work an exact science. The trouble very often is that advice is tendered, certified with the badge of authority from people who have no intimate knowledge of the internal practical activities of the foundry as a workshop. Fundamental principles and laws are set aside for unproved theories, which carry by their plausibility the likeness of facts. The trained foundry scientist, on the other hand, recognises those laws and tries, to the great benefit of the industry, to build on those principles and laws a much more efficient structure than existed before.

"The object of the scientist should be to extend the horizon of the foundryman by applied science, and not to theorise from inspiration. Therefore, through his mental make-up there should run a broad streak of practical application. The foundry does not welcome anyone who may come along with untried theories and uses the foundry to perfect them, and in the process leaves behind a stream of discontented people. The real scientific adviser gets the abstract idea and transforms it into a reality for the foundryman to use. Let the foundry industry eagerly grasp new ideas, help the scientist to put the results of his ultimate researches into commercial form, and so benefit the industry as a whole. The man who has studied for years with the object of becoming a foundry expert, whether his studies have been at college or in the workshop, is a very great asset to the foundry, but the person who qualified with as little discomfort as possible to himself, with no definite idea as to the future, is not a person wanted in the foundry industry.

A Technical Basis

"A tremendous amount of good will be done to the foundry industry (said Mr. Walker) when it is possible to say that every worker, besides being a skilled craftsman, is also in possession of a clear knowledge of the technical side of his trade. The skeleton of foundry practice can be taught in the classroom in a manner so successful that the practical side when acquired in the foundry will supply the required clothing for the bones. However, that clothing may be different according to whatever branch of the trade the wearer belongs. For example, he may be engaged on rainwater goods, or be a worker in general engineering castings, but whatever the class of work engaged in, the craft is still that of the foundryman, and as such is possessed of certain experiences, which make him a specialist in one branch, but with a knowledge of the rest sufficient, as in the work of this Institute, to be helpful to the general good. Whatever his particular special experience may consist of, we may take it that he came by it along no smooth path, but by one pitted by trial and error.

Foundry Education

"A difference in the sand used in a strange district, for instance, can make a very great variation, for a time at least, in a moulder's ability to produce satisfactory work. Very often a change of districts forces an alteration of values. What might be considered good practice in one district is discarded as bad practice in another. This is where the essential craftsmanship of the moulder tells, and each individual foundry craftsman is in himself a man who crudely interprets those facts which the scientist so lucidly expresses. This craft, still a feature of the foundry worker, is a relic—one of the few relics—of that skill in industry which for its preservation led to the formation of the Guilds in other days. Technical education gives to this craftsmanship the guidance it formerly lacked, but most unfortunately while we have, all over the country, classes and trained teachers ready for the teaching of the foundry worker of all ages, the response is most disappointing. We have cases of foundry classes opening with less than half-a-dozen enrolled pupils, even when the classes have been designed to give especial interest to the student.

Broader but Shallower

"In one way this is a sign of the times. Lads have an outlook which is very much broader than that of former generations, but at the same time their outlook is much shallower. Various arguments have been given for the non-attendance of lads at evening classes. Most of them are quite spurious. One excuse often held out for them is that after a hard day's work under foundry conditions the lads are too tired to attend evening classes. Personally, this leaves me without pity for the defendants. The true reason, in my personal view, is the lack of essential "guts." Conditions of hours of labour were never so favourable, and working conditions in the foundry are much better than formerly. Wise foremen do not make production an essential, and this latter condition is the one most enthusiastically observed by many of the lads.

"To my mind, attendance at an evening class should be made a condition of employment, and a further condition should be that their work at evening class should be of good report. By good report I do not necessarily mean 100 per cent. efficiency, but I do mean 100 per cent. effort. Conditions such as those may seem harsh, but if employers on their side met the tuition expenses the scheme would be admirable. After all, if a lad decides to take up a particular trade, it should be expected that the time and money expended on his training during apprenticeship should show a dividend, and if the lad cannot be wise enough to help himself to the gifts offered him, he should be forced to take them, and if he refuses, let him make way for those who will have them. The willing lad is the type we desire to staff our foundries in the future. We hear, too, much about not being able to get the right class of lad in the foundry. The answer to that is the younger members of our own Branch and of the Institute in general. Employers realise that the well-trained youth is a valuable asset, and schemes of apprentice education are prevalent in most up-to-date engineering works. Time and again have efforts to provide facilities for foundry apprentices been made until, to approach an employer's constituted authority, seeking aid for such schemes, evokes lukewarm response."

Advanced Training

Another phase of foundry education, said Mr. Walker, required more attention than it had been getting. This was the advanced training of foundrymen who no longer came under the

category of lads; men in possession of experience gained during apprenticeship, and probably with a training of some sort secured at evening classes. This group was composed of youths and young men whose more mature mentality and greater experience in most cases compelled them to adopt a policy which included a wider and more comprehensive idea of what they intended to do in the future. To the correct thinkers in this group, efficiency of foundry technique must enter largely. To such of them who were so inclined, facilities should be provided in the way of advanced foundry and pattern-making classes. As a rule these men would not enter classes including younger lads, but he (the speaker) was convinced a success could be made of classes composed mainly of young men who were no longer apprentices. The best-attended classes connected with foundry education, in the speaker's experience, were run on such lines under control of the local technical college authority.

"After all," Mr. Walker said, "the real importance of technical education for foundrymen is not to enable the moulder to produce from a wallet a certificate or certificates with a number of anything between 75 to 100 on it, nor that of creating a generation of certified foundry supervisors, but it certainly will assist the applicant to obtain such a post if he does possess such a certification. The foundry supervisor, with or without such a badge, will only be successful, as in the past, if he possesses the agile mind, some knowledge of handling labour individually or in bulk, and is gifted with infinite tact and good humour. The foundry supervisor who can control a shop efficiently and feel that his shop is a happy unit will still be in demand by employers, certificate or no certificate. Some things are not taught in class or college, and an understanding of human nature is one of them; and seeing the other point of view is another."

The amount of real ground work done in the interests of apprentice education by the officials of the West Riding Branch, proceeded Mr. Walker, had to be known to be appreciated. Mr. Worcester, their Past-President, had given a particularly great deal of time, and almost unceasing effort, in this cause, and the work, while bringing certain concrete results, had not met with the full measure of success the efforts deserved. "I give it as a personal opinion (said Mr. Walker) that many organisations which would have been glad to co-operate with and assist in attaining the object aimed at, were stalled into indifference by the failure of the lads themselves. As a rule, when one wants to say anything unpleasant, it is the fashion to cover it up with long words. The subject of apprentice education could be treated in this way by speaking of the psychological effect of developing the lads' human interests, but personally my belief in studying or developing the human interest of the average dodger of evening classes, whether he be of the foundry or any other trade, is nil. However, do not let us think that the matter is a factor beyond our shaping. Now that we have the Sheffield University Degree Course in being, the foundry lad and young man may see something worth obtaining as the result of studying foundry theory, and we may as a result have an influx of boys as apprentices who will be of the type we always deplored as being not attracted by the foundry.

The whole matter of apprentice education (said Mr. Walker, in bringing his address to a conclusion) is of sufficient importance to become a matter which should be dealt with as a national affair by the Institute of British Foundrymen and General Council. "There is one thing I most sincerely hope, regarding the future of this Branch, and that is that whatever advance is made in scientific endeavour, that whoever may be in this chair, whether he be a representative of the scientific, the commercial or the practical side of our industry, that the outlook of this Branch maintains a practical aspect on the affairs of the foundry, and that we as a branch will avoid the too academic plane. Let the Branch remain a practical branch for practical men, seeking the assistance of the trained scientist to keep them up to date and progressive, but never letting the Branch at any time be subservient to those without internal foundry connection."

Hearty thanks were awarded Mr. Walker for his address. The meeting was exceedingly well attended and among those present was Mr. Victor Stobie, M.I.E.E., Past-President of the Institute.

The discussion on moulding sands, opened by Mr. F. K. Neath, will be reported subsequently.

Annealing Malleable Iron

SMALL FURNACES PROVE ECONOMICAL

MR. L. J. WISE, writing in a recent issue of "Steel," states that during recent years the tonnage of malleable produced had increased simultaneously with the phenomenal growth of the automotive industry, and many plants had built more and bigger annealing ovens, the theory being that the larger the tonnage annealed per oven, the lower was the cost of annealing. Increasing the size of the ovens, obviously did not tend to reduce the annealing time. Several installations of continuous ovens were made, where production was sufficient to warrant it. However, even here, the prime factor was cost reduction, although there was a substantial reduction in time. During that era improved methods of firing were widely adopted, principally pulverised coal and oil. Here again the prime motive, as in the case of the continuous kiln, was cost reduction.

Shortly before the depression set in, the industry was shaken up considerably by the revelation that the annealing time could be reduced 50 per cent. or more by the use of electric heat-treating furnaces, accurately controlled and taking advantage of recently-developed theory that it was not necessary to cool at an extremely slow rate between the upper temperature and the critical range of 1,400-1,300 deg. Fah. However, like anything new, this process was not accepted readily by the industry as a whole for a number of reasons, chiefly the cost of electricity. The depression brought the period of hand-to-mouth buying. Foundries which formerly loaded one of their big ovens every day were putting their entire week's production into one oven and the vicious circle of dissatisfaction started. Buyers could not release orders until the castings were actually needed, and the foundry could not run a heat until it had accumulated sufficient orders. Buyers were forced to seek other sources of supply or use other materials if in any way possible.

To meet these conditions the malleable foundryman was forced to start annealing in smaller batches. The obvious answer was to run the big ovens one-half or one-third full. This was in many cases very costly from the standpoint of fuel, because of the tremendous absorption of heat units by the refractories. These conditions brought about the advent of the small oven, designed to anneal 5 to 10 tons of castings economically and rapidly. Probably, when many started to build the first small oven, it was done with a sigh of resignation, anticipating that something was being adopted which would increase the cost of production with no chance of getting it back in selling price. Actually, after nearly two years of experience with two 10-ton ovens, the author is convinced that annealing can be done in such quantities just as economically as in the old-style ovens, with nearly a 50 per cent. saving in time, with greatly increased flexibility of operating the annealing department and with immeasurably improved service to the customer.

Inefficiencies Eliminated

Contrary to many opinions, particularly on the part of the users of malleable castings, this is not due to any radical changes in metallurgical theories or to any mysterious developments in metal mixtures. The developments are rather the result of a realisation and study of methods of eliminating the mechanical inefficiencies present in the old-style ovens. Development of a satisfactory refractory insulating brick at a fairly reasonable cost called attention to the great number of heat units which were being absorbed by the fireclay brick and the possibility of eliminating this waste. This development, coincidental with the demand for small batch annealing, resulted in the design of a 10-ton oven to hold 12 stacks of pots.

Provision was made for the subsequent installation of a bogey to permit emptying and refilling of the oven at temperatures much higher than is possible when unloading by lift truck, but this has not been installed as yet. The fuel is oil. An average cycle in use to-day is as follows:—Time to reach soaking temperature, 900 deg. C., 24 hrs.; held at soaking temperature, 900-925 deg. C., 24 hrs.; cooling to 705-730 deg. C., 18 hrs.; held at 705-730 deg. C., 12 hrs., cooling to handling temperature, 18 hrs.; total, 96 hrs.

Packing material is used in all pots. Evidence of under-annealing is extremely rare. Fuel oil consumption averages the same per ton of castings annealed as in the old-style 25-ton ovens. Further savings in time and fuel are available upon the installation of the bogey. Still further reductions are possible with castings which lend themselves to annealing without packing material.

Anglo-German Payments Agreement

OUTSTANDING DEBTS

In order to obtain information as to debts due from traders in Germany to traders in the United Kingdom, the Board of Trade issued circulars in July and September last. This information was required for the negotiations with the German Government leading up to the agreement of November 1. It is now desired to obtain final statements for transmission to the German Government of the outstanding debts due to traders in the United Kingdom in the period March 1-October 31, 1934, with a view to liquidation under the terms of the agreement.

Details of outstanding debts due from German traders should be sent to the German Claims Section, Cornwall House, Stamford Street, London, S.E.1, from which the necessary forms can be obtained.

When the claims have been received they will be communicated to the German authorities with instructions as to the order in which exchange should be provided. It will be for the United Kingdom creditors to request their debtors to apply to the Reichsbank for the exchange necessary to enable the debts to be discharged. The Reichsbank will deal with these applications in the order of priority laid down, as and when exchange becomes available within the maximum period of 12 months provided for under the agreement.

New Alloys of Beryllium

According to the Beryllium Products Corporation, New York, a new nickel-beryllium alloy can be tempered by precipitation hardening so that it has a tensile strength of 259,000 lbs. per sq. in., with a yield point of 219,000 lbs. per sq. in., and an elongation of 8 per cent. Its Brinell hardness is then 460. Another alloy of beryllium with both nickel and chromium present has, after age-hardening, a tensile strength of 216,000 lbs. per sq. in., an elastic limit of 204,000 lbs. per sq. in., and an elongation of 11 per cent. It is stated that both of these alloys possess unusual corrosion-resistance properties with special reference to resistance to mineral acids at temperatures causing intergranular corrosion in some existing materials or alloys.—"Iron Age."

XUM

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This Week's News in Brief

Trade Talk

AN ENJOYABLE DANCE under the auspices of the Carron Works Lawn Tennis Club was held on November 16, and attended by over 200 persons.

MESSRS. PETER BROTHERHOOD, LIMITED, engineers, Peterborough, report a continued influx of orders for compressors, Diesel engines, steam turbines, generating sets, etc.

THE NEW SUBMARINE, "Espadatari," built by Vickers Armstrong at Barrow for the Portuguese Navy, has arrived in the Clyde and commenced trials which will last for about 10 days.

THE EMPLOYEES OF Messrs. William Simons & Company, Limited, engineers and shipbuilders, Renfrew, have contributed £156 for distribution among various charities in the West of Scotland.

THE L.M.S. RAILWAY COMPANY have placed a contract with the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow, for a new caisson to be installed at the Devonshire Dock, Barrow-in-Furness.

A LARGE RUSSIAN ORDER for steel has been secured by Colvilles, Limited, on which work is now in progress at the Dalzell plant, Motherwell. The order is one of the largest of its kind booked for several years.

SWEDISH PIG-IRON IMPORTS, which in January to August, 1933, totalled 2,500 tons, advanced to 4,100 tons in the same period of this year, owing to the low prices at which foreign irons have been offered and the marked increase in consumption.

A NEW DIESEL shunting locomotive has just been placed in service by the London Midland & Scottish Railway. It weighs 30 tons, and can haul loads of up to 700 tons. This engine is the largest of a series of four ordered by the L.M.S. from the Hunslet Engine Company, Limited, of Leeds.

MESSRS. STEWARTS AND LLOYDS, LIMITED, who, by arrangement with the trade unions, have been working the three-shift system for three months to finish urgent contracts, will revert to the two-shift system at their Tollcross Works, Glasgow, next week.

EXERCISING AN OPTION obtained when they placed an order a month ago, the United Africa Company have ordered another 8,000-ton cargo vessel from Messrs. William Hamilton & Company, Limited, of Port Glasgow. Work has already been started on the first vessel, and the second will be commenced at once.

IRON PAVING, LIMITED, has acquired the amalgamated interests of Iron Roads (Great Britain), Limited, and Iron Roads (Foreign), Limited. All communications should be addressed to Iron Paving, Limited, Abbey Road, Park Royal, London, N.W.10. Telephone number: Willesden 3761. Factory premises have been acquired there for the expansion of the company's business.

A MEMORANDUM HAS BEEN PREPARED by the Dalmuir workers' committee, in conjunction with the West of Scotland Engineering and Shipbuilding Federation, and also the Joint Trades Committee, to be sent to all Members of Parliament, in the hope that they will support Mr. David Kirkwood in any proposal he makes with regard to the retention of Messrs. Beardmore's marine engineering works at Dalmuir.

MESSRS. SCOTT & SONS, LIMITED, Bowling, have made contracts for the building of two steam tugs for the James Dredging, Towage & Transport Company, Limited, of London. One of the vessels will be fitted with engines of 600 b.h.p., and the other will have machinery capable of developing 1,000 b.h.p. In each case the propelling machinery, consisting of triple-expansion engines, will be manufactured by Messrs. Aitchison Blair & Company, Limited, Clydebank, and boilers will be supplied by Messrs. David Rowan & Company, Limited, Glasgow.

AFTER EXPERIMENTING for some time, the Singer Manufacturing Company, Limited, Clydebank, have decided to make the legs for their sewing-machine cabinets from cast iron, particularly for machines exported to Eastern countries. For some years these legs were made of wood to harmonise with the machine cabinet, but reports from abroad of the legs warping and causing the machines to rock have led the company to decide on cast-iron legs. As this involves a large order, it will mean much more work for the foundry and employment for more men.

TWO LARGE PASSENGER and cargo steamers of the Atlantic Transport Company—the "Minnetonka" and the "Minnewaska"—have been purchased by Messrs. Douglas & Ramsey, Glasgow, for Messrs. P. & W. MacLellan, Limited, Glasgow, and Messrs. Smith & Company, Limited, Port Glasgow, respectively, for breaking up. The "Minnetonka" is a geared turbine boat of 22,000 tons, and the "Minnewaska" is of 21,716 tons. Both were built by Harland & Wolff in 1923 and 1924. They have been purchased complete with fittings. The "Minnetonka" is the largest ship ever brought to this country for breaking up.

AT THE CUMBERLAND and Lancashire district delegate board of the National Union of Blast-furnacemen, Ore Miners, Coke Workers and Kindred Trades, at Workington, the district secretary submitted a report in which he stated:—"To my mind, one of the most important matters to report since the last meeting is the completion of a new furnace at Millom works. The lay-out and design so far as the furnace itself is concerned are on the latest modern lines. I look on this furnace as concrete evidence of the determination of the Millom Company to maintain their position as manufacturers of the very best grades of merchant iron. Millom is the only merchant plant in operation in the district."

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Leeds Alloys, Limited, 42, Bowman Lane, Leeds, 10.—Capital £1,000. Metalfounders. Directors: H. S. Inman and B. Marsden.

Astra Metals & Residues, Limited, Sentinel House, Southampton Row, London, W.C.1.—Capital £2,000. Dealers in copper, tin, zinc, lead, etc.

W. R. Barrett & Company (Metals), Limited.—Capital £1,000. Metal merchants. Managing director: W. R. Barrett, "Greenfield," Morriston, Swansea.

Wm. Glaser & Company, Limited, 35, New Broad Street, London, E.C.2.—Capital £100. Dealers in iron and steel, etc. Directors: W. H. Winn and J. O. Fowling.

Hallamshire Stainless Steel & Fitting Company, Limited, Rosedale Works, Rosedale Road, Sheffield.—Capital £2,000. Directors: Marion T. Green and W. H. Emery.

E. Mallalieu & Company, Limited, 10-12, Shaw Street, Dutton Street, Cheetham, Manchester.—Capital £200. Brass and iron founders. Directors: Mrs. D. M. Mallalieu and A. Lane.

Charlestown Engineering Company, Limited.—Capital £2,000. Steel manufacturers, manufacturers of iron and steel castings, etc. Subscriber: H. N. Sporborg, 18, Austin Friars, London, E.C.2.

Campbell's Furnaces, Limited, Bank Chambers, 329, High Holborn, London, W.C.1.—Capital £1,000. Manufacturers of and dealers in machinery and appliances. Directors: A. Campbell and D. S. Campbell.

Contracts Open

Shalfleet, November 27.—Supply and laying of 2¾ miles 8-in. dia. spun-iron service main, for the Isle of Wight Rural District Council. Mr. W. E. Blizard (Lemon & Blizard), Lansdowne House, Castle Lane, Southampton. (Fee £3 3s., returnable.)

Harpole, December 8.—(1) Pumping plant and accessories; (2) valves, hydrants, etc.; (3) construction of underground brick reservoir; (4) provision and laying of 3,500 yds. 3-in. spun-iron mains, for the Northampton Rural District Council. Mr. R. J. Miller, 20, The Millway, Duston, Northampton. (Fee £2 2s., returnable.)

Company Report

Birmingham Aluminium Casting (1903) Company, Limited.—Net profit, £25,664; brought in, £27,341; dividend of 10 per cent. on the ordinary shares; to reserve for special depreciation, £5,000; carried forward, £26,602.

Personal

MR. NIGEL CAMPBELL has joined the board of Messrs. Stewarts and Lloyds, Limited.

MR. WILLIAM SCOTT, who is nearly 90 years of age and who was for a long period of 65 years an important figure not only in Dunnikier Foundry, Kirkcaldy, but in various parts where the Kirkcaldy engines were installed, was met last week by a few old apprentices of the foundry and presented with a case of notes in token of their esteem and gratitude for the kindly assistance and wise counsel he had given them in their youth. Steam users all up and down the country and in other lands looked to Mr. Scott as their best friend in time of trouble. Despite his years, he continues to enjoy excellent health and remarkable vigour.

Will

WOODWARD, HENRY, of Birmingham, retired brassfounder £62,210

Obituary

THE DEATH OCCURRED recently of Mr. William Smith Scott, who for many years had been in the employ of Messrs. Babcock & Wilcox, Limited, Renfrew.

MR. JAMES ANDERSON, J.P., died at his home in Bonnybridge recently. Mr. Anderson, who was 82 years of age, remained active, and on the previous Saturday he presided at a meeting of the Cannerton Brickwork Company, Limited, of which he was chairman. Mr. Anderson was a native of Gartsherrie, but went to Denny when only four years old. He was chairman and managing director of seven limited-liability companies, including the Scottish Central Ironfounders Company, Limited, Falkirk.

WE VERY SINCERELY REGRET TO ANNOUNCE the sudden death last Friday of Mr. J. H. S. Dickenson, chief metallurgist and special director of the English Steel Corporation. Mr. Dickenson was appreciated internationally as both a sound and scientific metallurgist on account of the signal services he rendered to the metallurgical side of the automobile industry and because of his work in connection with the strength of materials under conditions of prolonged exposure to high temperatures and involved stresses. His academic distinctions were the award of the Mappin Medal, which he gained as a student, and the Crompton Medal awarded by the Institute of Automobile Engineers. To our mind, his researches have been inadequately recognised by those in a position to bestow honours in this direction, but his inherent modesty and the oftentimes confidential character of his work were not helpful. For instance, we are aware of much work in connection with the remelting of nickel-chrome steel in the cupola in about 1910, which has never been published. In recent years, he was taking an increasing interest in the foundry industry, and was a member of the Committee which published the First Steel Castings Report. Mr. Dickenson was 52 years of age, and leaves a widow and four children, to whom we offer our very sincere condolences.

Forthcoming Events

Institute of British Foundrymen

NOVEMBER 23 AND 24.

London and East Midlands Branches:—Joint conference in London. *Friday*: (1) Visit to works of the Ford Motor Company, Limited; (2) informal dinner. *Saturday*: (1) "Some Experiences in the Manufacture of High-Grade and Alloy Castings," by P. A. Russell, B.Sc.; (2) "Enamelling of Cast Iron," by B. B. Kent. Papers to be read at the Charing Cross Hotel, W.C.2, at 10 a.m.

NOVEMBER 30.

Scottish Branch:—Joint meeting with the Institute of Chemistry. "Recent Developments in Silicate Enamels, and the Study of their Industrial Uses," Paper by E. E. Geisinger, B.Sc., at the Royal Technical College, George Street, Glasgow, at 7.30 p.m.

The Institute of Vitreous Enamellers

NOVEMBER 28.

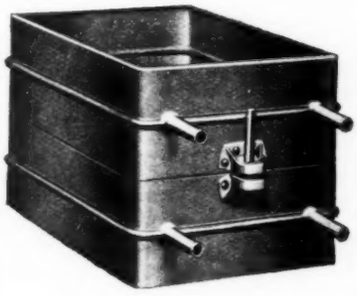
Midland Section:—"Costing for Vitreous Enamelling," Paper by W. Todd, at the Chamber of Commerce, New Street, Birmingham, at 7.30 p.m.

NOVEMBER 29.

Southern Section:—"Costing for Vitreous Enamelling," Paper by J. H. Coupe, at British Industries House, Marble Arch, London, W.1, at 8 p.m.

XUM

Sterling



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AGENTS:

GLASGOW: ALBERT SMITH & CO., 60, ST. ENOCH SQUARE, GLASGOW, C.1.

NEWCASTLE-ON-TYNE: PARSON & COLLS, CLARENDON HOUSE, CLAYTON STREET, W., NEWCASTLE-ON-TYNE.

MANCHESTER: F. L. HUNT & CO., CHAPEL STREET, SALFORD, MANCHESTER.

Raw Material Markets

A further slight expansion of business is reported in most sections of the iron and steel markets, and there is every prospect of the large producers being able to maintain their present rate of production over the winter, if not to improve upon it. A strong, steady demand for pig-iron is reported by the furnaces, the majority of which are heavily booked as far ahead as next March.

Pig-Iron

MIDDLESBROUGH.—Only four of the twenty-seven blast furnaces operating in this area are producing Cleveland foundry iron for the open market. The output is readily taken up and withdrawals have had to be made from the stocks which accumulated during the summer. In contrast to the strong domestic demand, export business in Middlesbrough iron has been very scarce, owing to drastic underselling by Continental competitors. There is still no hint of any variation in the range of pig-iron prices, the fixed minimum rates for home deliveries of No. 3 Cleveland G.M.B. being:—Middlesbrough, 67s. 6d.; North-East Coast, 69s. 6d.; Falkirk, 67s. 3d.; Glasgow, 70s. 3d. per ton. Half-a-crown per ton more than the foregoing figures is quoted for No. 1 foundry iron, and both No. 4 foundry and No. 4 forge are 1s. per ton less than No. 3.

Heavy deliveries of East Coast hematite are being made against existing contracts, as a consequence of the improving conditions in the steel trade. Business in the export markets has picked up slightly, and the improved figure of 62s. 6d. per ton f.o.b. has been realised for No. 1 East Coast hematite. The quotation for this grade delivered Middlesbrough is 69s. per ton. Delivered prices to other zones are unaltered.

LANCASHIRE.—Midland ironmasters report that deliveries of pig-iron into this area against running contracts are on a satisfactory scale, and that there has been a quiet flow of replacement orders as old agreements have run out. No major expansion of the demand is expected just yet; on the other hand, there is unlikely to be any falling-off. Quotations are firm, with offers of Staffordshire and Derbyshire brands of No. 3 foundry on the basis of 74s. per ton for delivery to Lancashire works. Northamptonshire at 72s. 6d., Scottish No. 3 at about 82s. 6d., East Coast hematite at from 75s. to 76s., and West Coast hematite at around 78s. 6d.

MIDLANDS.—Judging by the present increased demand for foundry iron, November should be the best month, from the furnaces' point of view, since July last. Many of the ironfounders report well-filled order-books and they are making inroads into their stocks. There have been no alterations in prices, the minimum controlled levels delivered Birmingham and Black Country stations, and subject to rebate in certain cases, being 67s. 6d. per ton for Northants No. 3 and 71s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3. There continues to be quiet expansion in the demand for iron for the engineering and jobbing founders. The qualities used are numerous, but they can be classified into three groups:—Medium-phosphorus at prices between 72s. 6d. and 80s.; low-phosphorus iron at 85s. to 87s. 6d. (Scottish No 3, which is offered at 85s. per ton, comes into the latter category), and then there is special refined iron for cylinder and similar work, which is quoted at figures between £5 7s. 6d. and £6 10s. per ton delivered South Staffs.

SCOTLAND.—Business in the pig-iron market is still limited, as there are many consumers who have already entered into forward contracts. There is no change in the price of Scottish foundry iron, which remains at the official minimum of 70s. f.o.t. furnaces for No. 3, with 2s. 6d. extra for No. 1. The Falkirk and district founders continue to take good deliveries of Cleveland iron, the quantity running to about 2,000 tons per week. There is no change in the prices of No. 3 Cleveland iron, which are 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow.

Coke

There is a steady demand for foundry coke. Prices remain firm, makers being heavily booked over the next few months. Current quotations for delivery in South Staffordshire are as follow:—Best Durham foundry coke, 36s. to 40s.; other qualities, down to 34s.; Welsh coke, 35s. to 45s., according to analysis; Scottish special coke, 40s. to 41s. per ton.

Steel

Steady conditions rule in the steel market, and the recent increase in the demand has been more than maintained, states the official report of the London Iron and Steel Exchange. There has been a certain amount of general buying, which usually takes place towards the end of the year, and works in most branches of the industry are assured of being able to operate at a fair rate of capacity until well into the New Year. Business in semi-finished steel has not been on an important scale of late, as most users have sufficient stocks on hand to meet their immediate requirements and are content to buy as the need arises. Although there has been a number of transactions in Continental material, by far the greater part of the business in this department has been taken by the English producers. Moderately busy conditions rule in the finished-steel section of the market. The recent improvement in trading has ensured steady working for some weeks to come, and the expansion in inquiry both on home and overseas account has given promise of a further increase in the demand.

Scrap

The scrap markets generally show a firm tone. In the Cleveland district, heavy metal and machinery metal are still obtainable at 52s. 6d. and 55s. per ton respectively, but for odd lots rather more has been paid. The Midlands market remains firm, prices being at the old levels. In South Wales, however, there is only a limited demand for heavy cast iron in large pieces and furnace sizes, which is unchanged at 47s. 6d. to 50s. per ton. Good cast-iron machinery scrap is also quiet at 47s. 6d. to 50s. Scottish foundries have recently been showing more interest in supplies of scrap iron, particularly machinery grade, which has changed hands at about 55s. to 56s. per ton.

Metals

Copper.—The market price of copper has declined during the past week. The demand from actual users is limited, but, nevertheless, consumption is moving along on satisfactory lines, both in this country and on the Continent. The market would soon make a rapid recovery if only American consumption were to improve in the same way, but that is a rather improbable happening as far as the near future is concerned.

Efforts are being made to bring together the shareholders of British copper companies with a view to the formation of an Association to safeguard their interests. It is suggested that an agreement should be arrived at between all copper producers to limit production for a period of years, with a view to stabilising copper on a higher price basis. The producers have been making efforts in this direction for some time past, but have so far been unable to reconcile their various interests.

Daily market prices:—

Cash.—Thursday, £27 17s. 6d. to £28; Friday, £27 to £27 2s. 6d.; Monday, £27 6s. 3d. to £27 7s. 6d.; Tuesday, £27 6s. 3d. to £27 8s. 9d.; Wednesday, £26 11s. 3d. to £26 12s. 6d.

Three Months.—Thursday, £28 3s. 9d. to £28 5s.; Friday, £27 7s. 6d. to £27 8s. 9d.; Monday, £27 12s. 6d. to £27 13s. 9d.; Tuesday, £27 12s. 6d. to £27 15s.; Wednesday, £26 18s. 9d. to £27.

Tin.—There has been no development of interest in the tin market. Dealing on the London market has been limited, and interest has centred mainly on to-day's meeting of the International Tin Committee at Paris. It was regarded as unlikely that the Committee will decide to make an increase on the present export quota of 40 per cent. of standard tonnages, in view of the fact that "world visible supplies" showed a considerable increase during October.

Price fluctuations:—

Cash.—Thursday, £228 5s. to £228 7s. 6d.; Friday, £228 5s. to £228 7s. 6d.; Monday, £228 7s. 6d. to £228 10s.; Tuesday, £228 12s. 6d. to £228 15s.; Wednesday, £228 10s. to £228 12s. 6d.

Three Months.—Thursday, £228 10s. to £228 12s. 6d.; Friday, £228 12s. 6d. to £228 15s.; Monday, £228 10s. to £228 12s. 6d.; Tuesday, £228 15s. to £228 17s. 6d.; Wednesday, £228 15s. to £228 17s. 6d.

Spelter.—The market price of foreign zinc has fallen below the £12 mark during the past week. Heavy offerings of Belgian zinc, excluded from the German market, have recently been made in London, and this has helped to depress prices. Considerable uncertainty is also felt regarding the future of the International Zinc Cartel, as production is on the upward grade in many countries, and the present Cartel restrictions on outputs are felt to be irksome. The scarcity of Empire brands of spelter continues, and heavy premiums are being realised.

Day-to-day quotations:—

Ordinary.—Thursday, £12 1s. 3d.; Friday, £11 18s. 9d.; Monday, £11 16s. 3d.; Tuesday, £11 16s. 3d.; Wednesday, £11 16s. 3d.

Lead.—Conditions in the market have changed but little, small fluctuations in price occurring from day to day. Supplies of Empire lead are still very difficult to come by.

Price fluctuations have been as follow:—

Soft Foreign (Prompt).—Thursday, £10 8s. 9d.; Friday, £10 6s. 3d.; Monday, £10 8s. 9d.; Tuesday, £10 10s.; Wednesday, £10 8s. 9d.

Cast-Iron Roads

At the Public Health Exhibition, which remains open until Saturday, there is an imposing exhibition of an iron-paved road which is of paramount importance to the blast-furnace owner, the ironfounder and the vitreous enameller. It has been manufactured and laid down by Iron Paving, Limited, of Abbey Road, Park Royal, London, N.W.10. Constructed according to Major F. W. Small's patents, it is made up of three-point suspension cast-iron tiles. Pedestrian crossings are marked out by means of yellow vitreous-enamelling the depressions. The following claims are made for cast-iron roads:—Freedom from skidding; absence of splashing; no gravelling required; minimum of upkeep costs; dustlessness; indefinite life, and high re-use value of the triangular plates. A lighter section of plate is being manufactured for the internal roadways of factories, especially those where freedom from dust is an essential. Fords at Dagenham have already installed a number of sections, which appealed to us as being both smart and efficient.

Applications for Trade Marks

The following list of applications to register trade marks has been taken from the "Trade Marks Journal":—

"ANTIGNIS" AND "KASIMIL."—Steel alloys. National Steel Foundry (1914), Limited, Kirkland Works, Leven, Fife.

"THOMAS BOLTON & SONS, LIMITED, OAKAMOOR AND FROGHALL, N. STAFFS—ESTD. 1783—BRITISH MANUFACTURE."—Bolts, studs, nuts, rivets, washers, railway and tramway bonds, couplings, locomotive firebox plates and stay-rods, copper pressings, welding electrodes, etc. Thomas Bolton & Sons, Limited, Hutchinson Street, Widnes; Oakamoor, Stoke-on-Trent, and Froghall, North Staffs.

"Æ."—Brass, copper, nickel, cupro-nickel and aluminium brass, in plates or bars. Allen Everitt & Sons, Limited, Imperial Chemical House, Millbank, London, S.W.1.

"NIFAL."—Iron alloys. Joseph Lucas, Limited, Great King Street, Birmingham, 19.

DEVICE, INCLUDING THE LETTERS "P. & C."—Metal castings in the rough. Phillips & Cross, Upper Sutton Street, Aston, Birmingham, 6.

"JAVELIN."—Metal in rods. British Insulated Cables, Limited, Prescot, Lancs.

THREE RINGS (device).—Unwrought and partly-wrought iron and steel and aluminium; alloy steels containing aluminium, titanium, molybdenum and tungsten. Fried. Krupp Aktiengesellschaft, c/o Brewer & Son, 33, Chancery Lane, London, W.C.2.

XUM

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for **CHILLED ROLLS,** CYLINDERS, CYLINDER LINERS, COG WHEELS FOR ROLLING MILLS, MORTAR MILL BOTTOM PLATES, STONE CRUSHER JAWS, PLOUGH-SHARES, ANVILS, AND ALL HIGH GRADE CASTINGS REQUIRING UNIFORMITY, DURABILITY, STRENGTH OR TOUGHNESS AND RESISTANCE TO GROWTH UNDER HEAT.

COLD BLAST PIG IRON IS THE BEST BASIS FOR ALLOY CAST IRON.

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NEW WORKS, LOW MOOR,
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MAKERS OF GENUINE COLD BLAST PIG IRON

RAW MATERIALS—PRICE LIST

(Wednesday, November 21, 1934)

COPPER

	£	s.	d.
Standard cash	26	11	3
Three months	26	18	9
Electrolytic	29	15	0
Tough	28	10	0
Best selected	29	0	0
Sheets	58	0	0
India	40	0	0
Wire bars	30	2	6
Ingot bars	30	2	6
H.C. wire rods	32	15	0
Off. av. cash, October	26	15	9 2/41
Do., 3 mths., October	27	1	8 30/41
Do., Sttlmnt., October	26	15	11 2/3
Do., Electro, October	29	17	6
Do., B.S., October	29	15	10
Do., wire bars, October	30	5	5 5/23
Solid drawn tubes			9½d.
Brazed tubes			9½d.
Wire			6d.

BRASS

Solid drawn tubes	8¾d.
Brazed tubes	10¾d.
Rods, drawn	8½d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7d.
Wire	7½d.
Rolled metal	6½d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	228	10	0
Three months	228	15	0
English	228	17	6
Bars	230	17	6
Straits	229	0	0
Australian (nom.)			—
Eastern	230	0	0
Banca	230	2	6
Off. av. cash, October	230	13	7 10/23
Do., 3 mths., October	228	16	9 23/23
Do., Sttlmt., October	230	13	8 8/23

SPELTER

	£	s.	d.
Ordinary	11	16	3
Remelted	13	0	0
Hard	10	5	0
Electro 99.9	14	8	9
English	12	18	9
India	12	0	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., October	12	5	8 11/23
Aver. spot, October	12	4	4 4/23

LEAD

	£	s.	d.
Soft foreign ppt.	10	8	9
Empire (nom.)	11	10	0
English	12	10	0
Off. average, October	10	9	1 13/23
Average spot, October	10	7	2 2/23

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex-whse.	22	17	6
Rods	27	0	0

ANTIMONY

	£	s.	d.
English	65	0	0
Chinese, ex-whse.	60	0	0
Crude			—

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to 11	10	0	

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	£8 17 6
45/50%	£13 0 0
75%	£18 7 6
Ferro-vanadium—	
35/50	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	5/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	£29 15 0
4/6% car.	£23 0 0
6/8% car.	£21 12 6
8/10% car.	£21 12 6
Ferro-chrome—	
Max. 2% car.	£36 0 0
Max. 1% car.	£38 15 0
Max. 0.70% car.	£42 0 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	15	0	to 2	16	0	
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to 2	12	0	
Heavy cast iron	2	7	6	to 2	10	0	
Good machinery	2	12	6	to 2	15	0	
Cleveland—							
Heavy steel					2	12	6
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	12	6	to 2	16	3	
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					3	0	0
Steel turnings, f.o.r.					1	14	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	12	6
Engineers' turnings					1	19	0
Cast-iron borings					1	17	6
Wrought-iron piling					2	11	3
Heavy machinery	2	15	0	to 2	16	0	

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	24	0	0
Brass	16	10	0
Lead (less usual draft)	10	0	0
Tea lead	7	0	0
Zinc	9	0	0
New aluminium cuttings	66	0	0
Braziery copper	19	0	0
Gunmetal	23	0	0
Hollow pewter	150	0	0
Shaped black pewter	112	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0	
Nut and bolt iron	7	10	0	to 8	0	0	
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.				12	0	0	
Gas strip	10	10	0	and up.			
Bolts and nuts, ¾ in. × 4 in.				14	0	0	
Steel—							
Plates, ship, etc.	8	15	0	to 8	17	6	
Boiler plts.				9	7	6	
Chequer plts.				10	7	6	
Angles				8	7	6	
Tees				9	7	6	
Joists				8	15	0	
Rounds and squares, 3 in. to 5½ in.				9	7	6	
Rounds under 3 in. to ¾ in. (Untested)				8	12	0	
Flats—8 in. wide and over				8	12	6	
,, under 8 in. and over 5 in.				8	17	6	
Rails, heavy	8	5	0	to 8	10	0	
Fishplates	12	5	0	to 12	10	0	
Hoops (Staffs)				9	7	0	
Black sheets, 24g. (4-t. lots)				10	10	0	
Galv. cor. shts. (,,)				13	0	0	
Galv. flat shts. (,,)				13	10	0	
Galv. fencing wire, 8g. plain				14	10	0	
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to 7	2	6	
Sheet bars	5	0	0	to 5	7	6	
Tin bars	5	2	6	to 5	7	6	

PHOSPHOR BRONZE

	Per lb. basis
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	11½d.
Rods	10d.
Tubes	13d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		18/2 to 18/7½
,,	28×20	,,	36/4 to 37/3
,,	20×10	,,	26/- to 26/6
,,	18¾×14	,,	18/9 to 19/-
C.W.	20×14	,,	16/- to 16/6
,,	28×20	,,	34/- to 35/-
,,	20×10	,,	23/3 to 23/6
,,	18¾×14	,,	16/3 to 16/6

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Nov.	15 ..	27	17	6	inc. 7/6
,,	16 ..	27	0	0	dec. 17/6
,,	19 ..	27	6	3	inc. 6/3
,,	20 ..	27	6	3	No change
,,	21 ..	26	11	3	dec. 15/-

Electrolytic Copper

		£	s.	d.	
Nov.	15 ..	30	10	0	dec. 5/-
,,	16 ..	30	5	0	,, 5/-
,,	19 ..	30	10	0	inc. 5/-
,,	20 ..	30	10	0	No change
,,	21 ..	29	15	0	dec. 15/-

Standard Tin (cash)

		£	s.	d.	
Nov.	15 ..	228	5	0	No change
,,	16 ..	228	5	0	,, ,,
,,	19 ..	228	7	6	inc. 2/6
,,	20 ..	228	12	6	,, 5/-
,,	21 ..	228	10	0	dec. 2/6

Tin (English ingots)

		£	s.	d.	
Nov.	15 ..	228	7	6	dec. 2/6
,,	16 ..	228	7	6	No change
,,	19 ..	228	12	6	inc. 5/-
,,	20 ..	228	17	6	,, 5/-
,,	21 ..	228	17	6	No change

Spelter (ordinary)

		£	s.	d.	
Nov.	15 ..	12	1	3	inc. 3/9
,,	16 ..	11	18	9	dec. 2/6
,,	19 ..	11	16	3	,, 2/6
,,	20 ..	11	16	3	No change
,,	21 ..	11	16	3	,, ,,

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Nov.	15 ..	14	13	9	inc. 1/3
,,	16 ..	14	11	3	dec. 2/6
,,	19 ..	14	10	0	,, 1/3
,,	20 ..	14	8	9	,, 1/3
,,	21 ..	14	8	9	No change

Zinc Sheets (English)

		£	s.	d.	
Nov.	15 ..	23	10	0	No change
,,	16 ..	23	10	0	,, ,,
,,	19 ..	23	10	0	,, ,,
,,	20 ..	23	10	0	,, ,,
,,	21 ..	23	10	0	,, ,,

Lead (English)

		£	s.	d.	
Nov.	15 ..	12	10	0	No change
,,	16 ..	12	10	0	,, ,,
,,	19 ..	12	10	0	,, ,,
,,	20 ..	12	10	0	,, ,,
,,	21 ..	12	10	0	,, ,,

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in October and the ten months, 1934, compared with a year ago.

	October.		Ten months.		October.		Ten months.	
	1933.	1934.	1933.	1934.	1933.	1934.	1933.	1934.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron, forge	—	—	—	—	—	—	—	—
,, foundry	4,486	2,721	32,077	25,057	17,229	8,242	115,193	72,719
,, acid	—	—	37	—	—	—	226	—
,, basic	3,000	9,338	43,322	63,587	7,975	26,544	115,799	176,311
Total (including other kinds)	7,486	13,096	75,436	100,627	25,204	41,249	231,218	318,642
Castings and forgings	187	217	930	3,230	3,922	5,317	21,489	80,495
Cast pipes and fittings	67	84	1,045	890	2,399	2,099	21,937	46,661
Stoves, grates, etc.	34	125	686	977	3,814	9,940	53,257	79,876
Baths	1,061	698	6,147	6,655	24,642	17,967	142,950	165,540
Hollow-ware, all kinds	397	141	2,202	1,919	12,817	9,090	86,823	110,879
Exports.								
Pig-iron, forge	184	115	1,815	1,025	823	516	7,210	4,331
,, foundry	4,023	6,012	38,813	59,068	13,005	21,632	134,749	202,324
,, acid	3,292	6,142	41,300	39,092	10,444	19,287	128,705	123,439
,, basic	60	—	1,302	832	201	—	4,984	2,725
Total	7,559	12,269	83,230	100,017	24,473	41,435	275,648	332,819
Castings and forgings	222	673	2,225	4,534	7,812	26,623	91,986	176,527
Cast pipes and fittings, up to 6 in. diameter	5,006	5,644	41,292	50,951	63,923	64,730	463,567	566,857
,, ,, ,, over 6 in. ,,	4,075	4,730	26,584	31,409	30,384	36,076	193,563	234,020
Stoves, grates, etc.	740	881	5,527	7,242	38,317	45,616	268,485	349,621
Sanitary cisterns	262	349	2,201	2,539	7,646	9,217	64,541	73,519
Bedsteads, inc. tubes therefor	468	405	3,354	4,234	15,333	14,642	120,860	140,977
Cast hollow-ware	493	373	3,519	3,065	17,902	14,981	138,742	117,232

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK
LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

CLERK, aged 22, used to costs, stock, desires change for experience.—Box 970, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN Patternmaker seeks position to take charge of patternshop; experienced in moulding-machine work, with excellent all-round knowledge of foundry methods. Keen supervisor.—Box 966, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

IRONMOULDER, with 20 years' sound practical experience in all kinds of rain-water goods, capable of introducing modern methods of manufacture, machines, plate-work, etc., desires position as Foreman or Assistant Foreman.—Box 972, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

TO any Foundry requiring a real live wire, young man, age 28, offers his services as Foreman or Assistant; thoroughly acquainted with all modern methods of production; well educated: good technical training; 12 years' practical experience; guaranteed to get results. —Box 954, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ESTIMATING Clerk wanted, used to estimating weights from blueprints for both small and large cast-iron castings for motor and other trades, and also judging best methods of making and fixing prices for coremaking, moulding, etc.—Apply, stating age, experience and salary required, otherwise application not considered, Box 962, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, Foundry Foreman, for small ironfoundry in Dorset; will be required to mould in his spare time; state age and experience.—Box 964, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, in the Midland district, Foundry Supervisor fully experienced in general cast-iron work, capable of taking charge mixtures and handling output up to 150 tons per week. One having experience in continuous casting preferred.—Reply, stating full particulars of experience and salary required, Box 968, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOUNDRY Foreman requires position. Excellent experience with high-class work, including repetition work and moulding machines. Metal-mixing. Accustomed to modern foundry plant, estimating and costing. (251)

STEEL-FOUNDRY Chemist and Metallurgist desires change. Also had steelworks experience. Thorough knowledge electric-furnace practice, alloy steels, heat-treatment. (252)

MACHINERY

WANTED, Hand Ram Turnover Moulding Machine to take boxes up to 4 ft. x 3 ft. 6 in.—BARTON BROS., LIMITED, Beck Works, Nottingham.

FOUR Osborn Jolt Press Moulding Machines, Type J.75, in perfect condition, cheap.—Write: ALEX. HAMMOND, Foundry Machinery Merchant, 14, Australia Road, Slough.

FOR Sale, 8-ton Wharton 3-Motor Electric Overhead Travelling Crane, span 37 ft. 9 in., £125. Also 6-ton Overhead Hand Travelling Crane, 37-ft. span, £30. Both delivered any station. Acceptance and inspection at South Bank.—Apply, E. HIND, South Bank.

3½-TON Brackelsberg Rotary Furnace, complete with equipment, equal to new. Tilghman 12-ft. x 9-ft. Sand-Blast Room, with exhauster and equipment. Above lying at Lowmoor Foundry.—Communicate with ALEX. HAMMOND, Foundry Machinery Merchant, Slough.

ONE Britannia latest-type Jolt Roll-over Moulding Machine, largest size, with pattern plate 6 ft. by 4 ft., giving about 20 in. clear draw; practically new condition, lying at Keighley. This machine is as new, and will be sold cheaply to avoid bringing to Slough stock.—If interested please write to: ALEX. HAMMOND, Foundry Machinery Merchant, 14, Australia Road, Slough.

JACKMAN Sand-Blast Cabinet, *high-pressure type*, size 6 ft. x 3 ft. x 3 ft., consisting of cabinet with all equipment, sand elevator, air compressor, exhauster, etc., as new. Cheap for prompt disposal. — ALEX. HAMMOND, Foundry Machinery Merchant, 14, Australia Road, Slough.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

SANDBLAST PLANTS

Room Plants, sizes 12 ft. x 12 ft., 12 ft. x 9 ft. and 6 ft. x 6 ft., made up in cast-iron sections.

Barrel Plants, 30 in. dia. x 36 in. long and 30 in. dia. x 18 in. long rotary barrels.

Cabinet Plants, in sizes 4 ft. x 4 ft. x 4 ft., 36-in. dia. and 30-in. dia. operators' cabinets.

Most of the above by Tilghman and complete with Air Compressors.

HAND MOULDING MACHINES

By Adaptable, Pridmore, Darling & Sellars, etc.; Squeezers by Utard (unused), Samuelson and Britannia, also Farwell Universal Type.

Ladles, Grinding Machines, Exhaust Fans, Blowers, Air Compressors and 500 Electric Motors and Dynamos.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.

CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.

'Phone: Broadwell 1359.

THOS. W. WARD LTD.

Hydr. PUMP, 3, 2½" dia. rams x 12" str.; 1,500 lbs. press.; motor-dr.

340 cub. ft. cap. belt-dr. AIR COMPRESSOR, 380 revs.; 15" press.; 2" dia. inlet x 1½" dia. outlet.

Steel-framed BUILDING, 188' x 171' span, in three bays 57' each, 22' to eaves.

16,000' 2" dia. S. & S. PIPING.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued*

LADLES—1X STOCK.

25-Ton Stevenson.
20-Ton Stevenson.
16-Ton Stevenson.
15-Ton Stevenson.
12-Ton Evans.
10-Ton Evans.
8-Ton Evans.
6-Ton Evans.
5-Ton Evans.

Forty smaller Ladles in Stock.

A. HAMMOND,
Foundry Machinery Merchant, Slough.

MISCELLANEOUS

SAFEGUARD your castings in transit by using "Untearable" Metal-backed Labels (good writing surface). Samples and prices free.—OXSPRING LABEL MANUFACTURING COMPANY, 39, Arundel Street, Sheffield.

TRY our IRON CEMENT, WAX CORE VENTS and PARTING POWDER. "The right articles at the right prices"—carriage paid and quick despatch!—WM. OLSEN, LIMITED, 68, Cogan Street, Hull.

FREE TO ALL DISCERNING FOUNDRYMEN, A NOVEL FEATURED, METALLURGICAL, FOUNDRY AND REFRACTORY GUIDE. SENT POST FREE UPON APPLICATION TO—Box 942, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

'Phone: 287 SLOUGH

MOULDING MACHINES

14"×16" TABOR split pattern.
18"×36" TABOR rollover shockless.
36"×24" TABOR rollover shockless.
40"×30" TABOR rollover shockless.

HAND Machines taken in part payment for above or exchanged.

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